μK MICROSYSTEMS NETWORK

UKRI Engineering and Physical Sciences Research Council

The Invisible Frontier

Towards a UK microsystems strategy

About this project

This study presents the first comprehensive assessment of the UK microsystems sector, combining an economic impact assessment with an analysis of global market trends, a review of the UK's strategic strengths and vulnerabilities, and five recommendations for policy and industry action. The economic assessment draws on firm-level data compiled from Companies House and The Data City, combined with an input-output framework using ONS data to quantify the sector's footprint across two principal channels: the direct activity of microsystems firms, and the supply chain effects that flow from it. The report draws on a programme of expert interviews conducted across industry, academia, and government. This report was written by Adam Green and Samantha Guerriero at Type Ventures, with editorial production assistance from Oriana Campbell-Palmer. Economic modelling was conducted by Gabriele Bowen at Mount Crescent Research.

The UK Microsystems Network is grateful to the following for their time and insights:

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- **Brendan Casey**, chief executive officer at Kelvin Nanotechnology Ltd
- **Angus Condie**, director of technology at XAAR
- **Lorna Ewart**, chief scientific officer at Emulate Bio
- **John Goodenough**, professor of microelectronic systems at the University of Sheffield
- **Richard Hammond**, chief technology officer at Fluidic Sciences
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- **Iain Mauchline**, head of semiconductors and innovation lead for electronics, sensors and photonics at Innovate UK
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- **Ian Sturland**, micro- and nanofabrication expert/consultant at Folium Optics
- **Anne Vanhoestenberghe**, director at MAISI and professor of Active Implantable Medical Devices at King's College London
- **Philip White**, technology specialist at the Department for Business and Trade
- **Eric Yeatman**, professor of microengineering at Imperial College London and vice-principal at the University of Glasgow

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Foreword

The technologies that will define the coming decades, from autonomous defence systems and novel medicines to AI infrastructure, share a common dependency. They all rely on a technology that operates at scales barely perceptible to the human eye, where physics behaves differently and where sensing, actuation, and integration come together in ways that conventional engineering cannot deliver. This is microsystems, a family of technologies that encompasses microfluidics, microelectromechanical systems, microsensors and more. They are the tiny devices that let a smartphone know which way is up, the microscopic channels that move single droplets of blood across a diagnostic test, and the precision sensors that keep a drone flying steady when satellite signals drop out.

Dr Gerard Cummins

Associate Professor,
University of Birmingham

The UK is well-placed in this field. This report sets out, for the first time, the scale of what we have built. A sector generating £3.1 billion in total economic output and supporting more than 15,000 jobs. The microsystems firms at the heart of this operate at a productivity rate 26 per cent above the national average. World-class research groups, specialist fabrication facilities, and clusters of companies competing quietly at the technological frontier of high-value niches. A position built patiently over decades by engineers and scientists working in the design, fabrication and integration of these devices, but this capability now at risk, if lost, will be challenging to recover.

Recognition of microsystems, as other nations have begun to do so, is what is needed in the UK. Canada has placed microsystems alongside quantum, photonics, and compound semiconductors as a strategic pillar. The United States has long maintained a dedicated capability through DARPA. The European Union is investing at scale in shared infrastructure for advanced packaging and heterogeneous integration. The competitive positions that will shape the next twenty years are being set today, and the investments being made now will determine who captures value from the trillion-dollar markets converging on this area.

The UK does not need to compete on volume manufacturing or match the capital scale of larger economies. Our advantage lies in the depth of our engineering expertise, the quality of our research base, and our existing industrial activity. What we need is greater cohesion to let these strengths work together, maximising their benefit. That means a coherent talent pipeline from schools through to mid-career roles in fabrication and packaging. It means investment funding that reflects the longer development cycles of hardware. It means shared infrastructure that smaller firms can access without bearing the full capital burden of ownership. And it means recognising microsystems within UK industrial policy, so that capital, talent, and policy attention can be oriented towards them.

The five recommendations set out in this report are practical and proportionate. All are built on the capabilities that already exist within the UK. Taken together, they offer a route to translate world-class research and specialist industrial strength into sustained competitive advantage across health, defence, digital infrastructure, and energy.

Finally, I am grateful to the many colleagues across industry, academia, and government who contributed their time and insight to this work. Their candour, expertise, and willingness to speak plainly about both the strengths and the gaps in our ecosystem have shaped every part of what follows. The opportunity before us is real, the window is open, and the case for acting now is clear. I hope this report helps make that case and bring microsystems the strategic recognition it has long deserved.

> “The competitive positions that will shape the next twenty years are being set today, and the investments being made now will determine who captures value from the trillion-dollar markets converging on this area.”

Executive summary

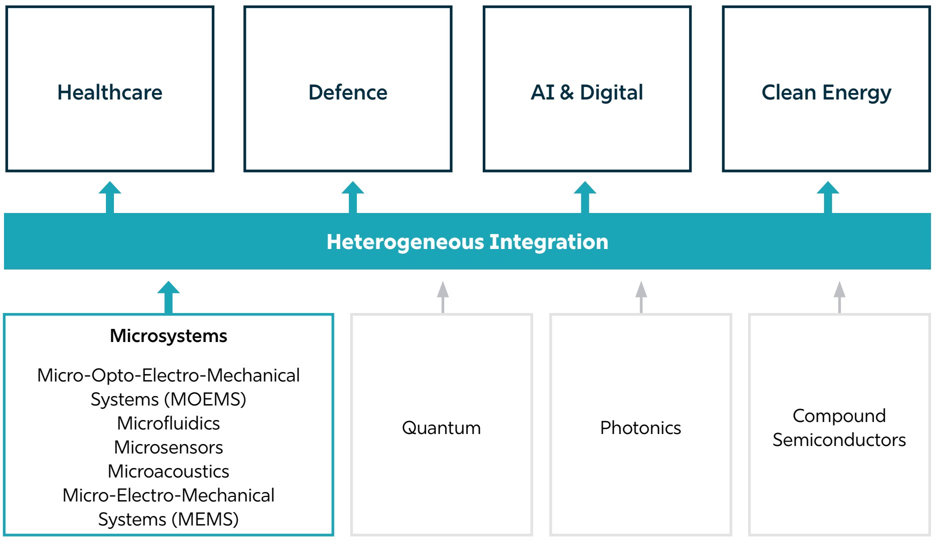
Inside everyday products—from smartphones and vehicles to medical devices—and within critical infrastructure most people never encounter, sits a largely invisible layer of technology: microsystems. Operating at the nano- to micro-scale, where physical behaviour changes in ways conventional engineering cannot access, microsystems enable downstream technology to sense, process, and act on the physical world with precision.

The UK has demonstrable strengths in this cross-cutting field: world-class research, specialist fabrication facilities, and clusters of companies that compete at the technological frontier of high-value niches. These strengths are evident in the scale and productivity of the UK's microsystems industrial base: microsystems companies alone generate £2.1 billion in direct output, contribute £860 million to UK GVA annually and directly support 8,970 jobs, with wider supply chain effects increasing this footprint by approximately 50%. This performance reflects a high-value, high-productivity sector, with output per worker 26% above the national average.

Competitive positions in markets where the UK's microsystems base is active are now being defined, and the investments made today will determine who captures value over the coming decades. This opportunity is driven by converging demand across health, defence, digital infrastructure, and clean energy—key growth engines that create shared demand for common microsystems capabilities in areas where the UK has proven strengths. How far this position—built through decades of research excellence and deep engineering expertise—translates into commercial advantage will depend on the conditions that support coordination, scale-up, talent, and investment across a currently distributed ecosystem.

FIGURE 1

Microsystems enables frontier technologies to become deployable applications.



Direct economic contribution of UK microsystems firms

generate
£2.1 billion
annually

contribute
£860 million
to UK GVA

support
8,970 jobs
within the UK

Including supply chain effects, the sector's total economic footprint rises to **£3.1bn** in output, **£1.3bn** in GVA and **15,000+** jobs—see Figure 7.

This report, produced by the UK Microsystems Network, quantifies the UK's microsystems industry and identifies five critical levers to translate its world-class capabilities into a self-reinforcing industrial base, namely:

1	Position microsystems as an enabling layer of UK technology and industrial strategy	Recognise microsystems across relevant Industrial Strategy sector plans and technology strategies—including defence, life sciences, digital and technologies, and advanced manufacturing—and establish it as a named strategic capability in the next iteration of the UK Industrial Strategy.
2	Enable deep tech companies to scale through dedicated growth financing	Introduce a dedicated scale-up mechanism—through the British Business Bank or National Wealth Fund—for hardware and integration-intensive companies, structured around innovation contracts and aligned to the longer development cycles of physical technologies.
3	Invest in shared fabrication and advanced packaging infrastructure	Support the launch and operation of MICROCRAFT as the UK's open-access microsystems development platform, and extend this capability to shared advanced packaging accessible at the prototyping and pre-production stage that complements the UK's emerging heterogeneous integration research agenda from CHIMES IKC.
4	Build a coherent microsystems talent pipeline	Establish a coordinated microsystems talent pipeline from school to mid-career—modelled on the National Quantum Strategy approach—combining school-level awareness, funding aligned to lab-intensive degree provision, and employer-led apprenticeship pathways into fabrication, packaging, and integration roles.
5	Systematise coordination across the ecosystem	Strengthen coordination across the microsystems ecosystem by creating systematic links between skills, research, and industry through shared capability mapping and a specialised cross-institutional Doctoral Focal Award investment.

Key findings at a glance

Microsystems is a high-productivity sector, already playing a central role in delivering the UK's industrial strategy.

Generating £3.1 billion in total output (direct and supply chain) and £1.3 billion in total gross value added (GVA), and supporting over 15,000 jobs, the sector combines high productivity with a strong supply chain multiplier, where every 10 roles sustain a further 7 across the UK economy. Microsystems activities support systems and applications across the UK's defence, health, digital, and advanced manufacturing sectors.

Multiple high-growth global markets are powered by the same microsystems capabilities.

While key strategic sectors such as life sciences, defence, AI infrastructure, and clean energy are fuelled by their own catalysts and pressures—including regulatory change, sovereign requirements, and the sustainability imperative—they are driving a shared demand for advanced fabrication, packaging, and system integration, shining a spotlight on the microsystems layer that underpins these sectors and their projected trillion-dollar scale.

Competitive advantage is shifting towards integration, packaging, and specialised engineering, aligning with areas of UK strength.

As technologies mature, competitive outcomes are increasingly decided at the packaging and integration stage—which can account for up to 80% of device cost—aligning with established UK strengths in specialist fabrication, heterogeneous integration, and bespoke engineering for high-reliability applications, supported by specialist facilities across the country and the recently established CHIMES Innovation and Knowledge Centre (IKC)[1] for heterogeneous integration research and industry adoption.

The UK's discovery funding ecosystem consistently produces strong microsystems ventures, with clear pathways to anchor more long-term value domestically.

With domestic participation in late-stage deep tech funding at 9%, microsystems companies often turn to international capital at the point of scale. UK firms nonetheless demonstrate the ability to scale globally through sustained demand, specialist capability, and proximity to research, highlighting a significant opportunity to retain more long-term value within the UK by aligning funding, demand, and scale-up pathways more closely.

Microsystems growth at scale depends on a coordinated talent pipeline from school to mid-career.

A combination of limited awareness at the school level, shortages in specialist fabrication and integration skills, and a significant portion of the workforce approaching retirement exposes a structural need for renewal. Employer-led training models and national programmes in adjacent fields show that such a pipeline can be achieved, but on timescales that require early and sustained commitment.

The UK's distributed microsystems infrastructure provides the foundation for a coherent national system.

Specialist facilities, research institutions, and academic cleanrooms span much of the value chain, but the majority of this capacity operates at low technology readiness levels (TRLs)—oriented towards fundamental research rather than the development and scaling of devices towards commercial viability. The MICROCRAFT facility at Southampton[2], currently seeking dedicated funding, is poised to become an ecosystem anchor in translating low-TRL research into manufacturable devices, once operational, by offering open-access technology development in the UK for micro- and nano-electromechanical systems to both researchers and companies without in-house capability. With relatively modest investment in shared access, maintenance, and visibility, these assets could operate as a platform to support microsystems research through to industrial deployment

Microsystems' value is built through integration, making coordination and shared advocacy central to how the sector scales.

Industry–academia collaboration, translational infrastructure, and commercialisation frameworks all sit within the UK, yet their links typically depend on individual relationships and project-level initiatives rather than systematic structures. Shared capability mapping and specialised research-to-industry initiatives would give the ecosystem the connective tissue to compound its world-class capabilities into sustained industrial advantage.

I

The industry inside everything

Across the modern economy, the most consequential components are often not the largest and most visible. They include microfabricated structures—sensors, channels, mirrors, membranes—that operate at tiny scales but enable the delivery of critical systems and technologies.

Inside a drone, a silicon resonator about the size of a pencil tip vibrates at thousands of cycles per second,[3] measuring angular motion with enough precision to maintain navigation when GPS signals fail. Inside an electric vehicle's power module, microfabricated sensors detect current and position by measuring magnetic fields generated by flowing charge,[4] providing real-time feedback that enables efficient control of energy flow from battery to motor. Inside an advanced medical device, micrometre-scale electrodes interface directly with neural tissue[5] to record and stimulate electrical activity, supporting precise diagnosis and treatment for neurological disorders.

> Microsystems are the invisible substrate of the frontier economy, underpinning critical technologies from life sciences and defence to digital infrastructure and clean energy.

> “DNA sequencing is a perfect example: exquisite microfluidics capturing DNA strands on a surface, creating a set of biochemical reactions you are controlling and managing to gather information and data. The only sensible way to measure biology, which is extremely heterogeneous, is via ultra-miniaturisation.”
>
> **Richard Hammond**
> CTO, Fluidic Sciences

These are microsystems: technologies built using micro- and nanofabrication—mostly sharing core approaches similar to those used to produce semiconductor chips—to exploit scale-dependent physical effects (a more detailed definition is provided in Appendix A. Defining microsystems). At these scales, phenomena that are invisible in everyday engineering become controllable and useful, opening up new ways to detect, measure and interact with the world. These effects are harnessed in components that perform specific sensing or actuation functions, but their greater significance lies in how they can be co-fabricated and integrated—combining sensing, processing, and control within a single chip or package. This integration is what makes microsystems so widely enabling across sectors.

But the blurring of boundaries between microsystems and the applications they enable can make microsystems difficult to define, and easy to conflate with adjacent fields such as compound semiconductors, photonics, and quantum technologies, which share fabrication infrastructure. In practice, microsystems are better understood as an expression of a shared capability, grounded in the same manufacturing foundation and underlying physics. Micro-electromechanical systems (MEMS) integrate microfabricated mechanical structures with electronics to sense acceleration, pressure, rotation, and sound; they are why a smartphone knows which way it is tilted and why a car's airbag knows to deploy. Microfluidics control fluids at the microscale, enabling lab-on-chip diagnostic devices, organ-on-a-chip disease models, and the inkjet printheads that deposit functional materials in advanced manufacturing. Microsensors transduce physical or chemical signals into electrical ones, underpinning everything from industrial process monitoring to implantable medical devices.

Microsystems subdisciplines share tools, facilities, and expertise; separating them is more a taxonomic convenience than a technological reality. What unifies them—and where much of the value resides—is advanced packaging and heterogeneous integration: the combination of different technologies components into a single deployable system. When combined, they enable systems that would be impossible within any single capability.

CASE STUDY

Oxford Nanopore Technologies: Genomics in your pocket

A DNA sequencer the size of a chocolate bar, capable of reading a human genome in hours while streaming results in real time, illustrates a defining feature of microsystems: compressing complex laboratory workflows into portable, integrated devices.

Founded in 2005 as a spinout from the University of Oxford, Oxford Nanopore Technologies has scaled that capability into a global platform. By 2025, it reported £224 million in revenue,[6] a rate of 24% year-on-year growth, serving clinical research, biopharma, and industrial markets across over 120 countries.[7]

At the core is its MinION device,[8] capable of reading DNA in real time by pulling it through a tiny nanopore, where each genetic letter creates a distinctive electrical signal. That signal is captured by a microfabricated chip and custom electronics, which are translated by software into a DNA sequence.

Every layer of that process—the microfabricated sensor array, the microfluidic sample delivery, the custom silicon readout, the on-device computation—involves microsystems.

Together, this tightly integrated system compresses a lab process into something you can plug into a laptop. This changes where and how genomics can be done: Oxford Nanopore technology has sequenced pathogens during Ebola outbreaks in remote field conditions, tracked SARS-CoV-2 variants in real time[9] during the COVID-19 pandemic, and made genomic analysis accessible far beyond major research centres. This is a product that could only have been designed by combining biology, microfluidics, semiconductor fabrication, and AI in a single system—the kind of multidisciplinary challenge microsystems translate into globally competitive, field-deployable technology.

II

Sizing the opportunity

The UK has committed significant public investment to frontier technologies over the past decade: photonics, quantum, and compound semiconductors each benefiting from dedicated strategies, research programmes, and industrial clusters.

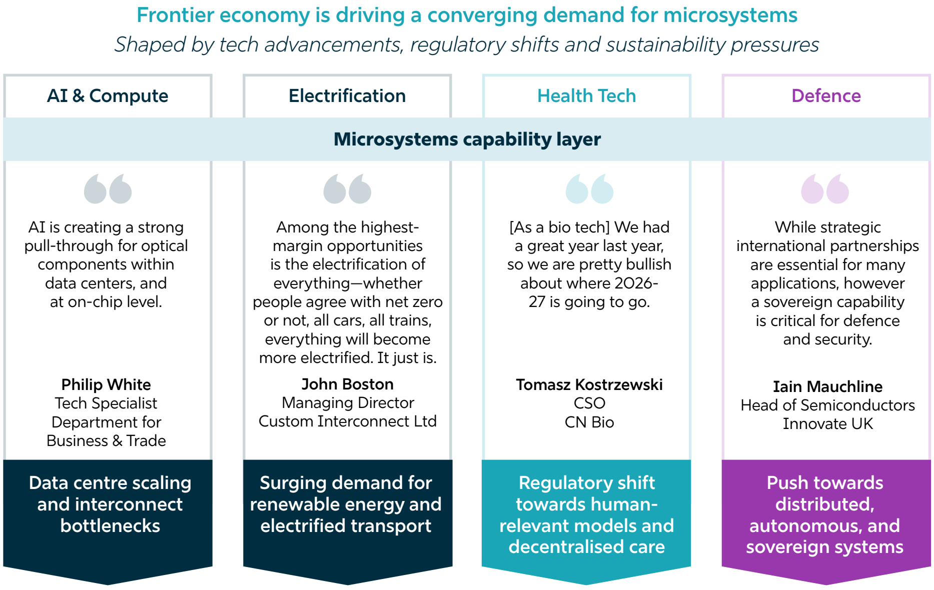
Microsystems, a distinct but equally critical technology layer that enables them to work cohesively within and across physical domains, is yet to receive equivalent strategic attention, even as the markets driving demand for it are expanding. Canada's FABrIC initiative[10] provides a notable comparator, treating microsystems as the fourth pillar of the same technology portfolio—a reminder that the infrastructure investments being made now by early movers will determine who captures value over the next decade.

A converging global market moment

Demand for microsystems capabilities is accelerating, partly thanks to technical improvements at the device level, which make new applications physically possible. But there are deeper, tidal forces at play. Pharmaceutical companies are exploring novel research approaches to tackle intractable diseases. Sovereign capabilities in manufacturing and critical technology are coming into vogue in a fractured geopolitical environment. Planetary boundaries are forcing breakthroughs in energy. And artificial intelligence is powering product innovations from everyday gadgets to medical R&D. Each of these shifts is independent; together, they mark a global market moment in which multiple high-growth sectors are simultaneously pulling on microsystems.

FIGURE 2

Key high-growth sectors—health, defence, AI, and electrification—are driving demand for the same underlying microsystems capabilities in fabrication, packaging, and system integration.



Frontier economy is driving a converging demand for microsystems

Shaped by tech advancements, regulatory shifts and sustainability pressures

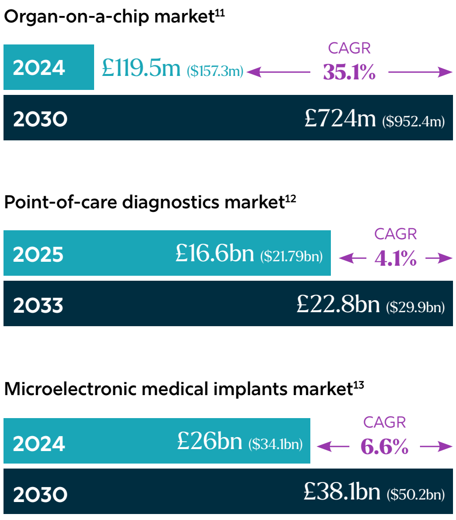
AI & Compute	Electrification	Health Tech	Defence
Microsystems capability layer			
AI is creating a strong pull-through for optical components within data centers, and at on-chip level.	Among the highest-margin opportunities is the electrification of everything—whether people agree with net zero or not, all cars, all trains, everything will become more electrified. It just is.	[As a bio tech] We had a great year last year, so we are pretty bullish about where 2026-27 is going to go.	While strategic international partnerships are essential for many applications, however a sovereign capability is critical for defence and security.
Philip White Tech Specialist Department for Business & Trade	**John Boston** Managing Director Custom Interconnect Ltd	**Tomasz Kostrzewski** CSO CN Bio	**Iain Mauchline** Head of Semiconductors Innovate UK
Data centre scaling and interconnect bottlenecks	Surging demand for renewable energy and electrified transport	Regulatory shift towards human-relevant models and decentralised care	Push towards distributed, autonomous, and sovereign systems

Life sciences are moving into the body, the home, and the lab simultaneously

In life sciences, microsystems are unlocking capabilities once constrained by scale and biology, catalysing three shifts, each large enough to reshape a sector on their own:

FIGURE 3

Three life sciences markets, at different stages of maturity, are creating shared demand for the same microsystems layer.



Sources: Grand View Research

1. Pharmaceutical R&D is shifting towards human-relevant models.

Ninety per cent of drugs that enter human trials fail to reach approval[14]—a failure rate that, despite decades of effort, animal-based preclinical models have proved unable to reduce. Organ-on-a-chip platforms address this directly: microfluidic devices built from microfabricated channels and living human cells that more closely replicate organ-level physiology in vivo than conventional models offer a credible path to improving early-stage decision-making and reducing costly late-stage failure by identifying the most promising candidates.

The regulatory environment has shifted to match. Following the FDA Modernization Act 2.0[15] in 2023, the UK published its 2024 roadmap for phasing out animal testing[16] leading to what industry participants now describe as a critical two-to-three-year window in which regulatory mandate and commercial readiness will need to converge into sustained procurement volume. Companies with significant UK operations—including Emulate, which develops human-relevant organ-on-a-chip systems that replicate tissue-level biology for drug testing,[17] and CN Bio, a UK-based manufacturer of multi-organ microphysiological systems designed to model systemic drug response[18]—already deploy multi-organ in vitro systems to pharmaceutical customers across the world, within a global organ-on-a-chip market projected to grow more than sixfold by 2030.[19]

> This is all coming to the fore now because it's an ecosystem. It's not just about any one person, any one company, or any one stakeholder: the regulators are now engaging in new ways, and industry follows through."
>
> **Lorna Ewart**
> Chief scientific officer, Emulate

2. Diagnostics is transitioning from central labs to point-of-care delivery.

Diagnostics has historically been organised around centralised laboratory infrastructure optimised for throughput and cost efficiency. That model introduces inherent latency between sample collection, processing, and clinical decision-making—delays that England's National Health Service (NHS) has identified as a constraint on effective care pathways,[20] particularly in acute settings and long-term condition management.

Microsystems-enabled point-of-care platforms reshape how diagnostics are delivered by integrating sample preparation, amplification, and detection within compact devices deployable in GP surgeries, community pharmacies, and the home. Microfluidic devices such as lateral flow tests and lab-on-chip molecular diagnostics as well as MEMS-based biosensors can compress what was previously a multi-step laboratory workflow into a single interaction at or near the patient.

This transition towards point-of-care diagnostics is being operationalised through the rollout of 170+ NHS Community Diagnostic Centres[21]—a nationwide expansion of diagnostic capacity into community settings that creates a scalable deployment environment for near-patient testing technologies. The UK's combination of coordinated procurement and domestic microsystems capability creates the potential for a tight coupling between deployment and iteration, offering companies both a market and a clinically grounded testbed, against a backdrop of a global point-of-care diagnostics market already worth tens of billions and still expanding.[22]

3. Medical devices are converging towards intelligent, implantable systems.

Medical devices are undergoing an evolution from discrete, function-specific tools towards integrated therapeutic systems that operate continuously within the body. Devices such as pacemakers, cochlear implants, deep brain stimulators, and emerging neural interfaces benefit from microsystems architectures that integrate sensing, actuation, computation, and communication within tightly constrained form factors and biocompatibility limits.

This evolution is being driven by both demographics and disease burden: ageing populations[23] and the rising prevalence of chronic conditions[24] —particularly cardiovascular and neurological disorders—are increasing demand for durable therapeutic systems capable of operating reliably over long time horizons.

In parallel, advances in low-power microelectronics, wireless power transfer, and embedded AI are enabling closed-loop devices that continuously adapt therapy to patient-specific signals.

Innovation is now centred on how these components are brought together: integrating MEMS sensors, Application Specific Integrated Circuits (ASICs), microbatteries, and advanced materials into cohesive, failure-tolerant systems that can function safely within the human body, making packaging, power management, signal integrity, and regulatory validation defining constraints. The multidisciplinary engineering depth developed across UK research groups and companies is well aligned with these demands, creating a clear opportunity within a global microelectronic medical implants market projected to grow to more than £38 billion ($50 billion) by 2030[25] as chronic disease burden rises.

> Health tech could make much more use of microsystems [in point-of-care]. We could be making more devices, like the semiconductor ASICs designed for ECG monitoring, but integrated with sensing and processing. There is real potential in bringing health tech and microsystems closer together.”
>
> **Simon Johnson**
> Chief technologist, the Centre for Process Innovation (CPI)

Defence is recalibrating towards distributed autonomy at the microscale

Defence electronics are being pushed to new physical limits of size, performance, and resilience, driven by a desire for autonomous operations in conflict zones and the need for domestic control over critical technologies.

1. Defence systems are being compressed into distributed, microscale architectures.

Defence capability is moving from large, platform-based systems and towards distributed, miniaturised, and increasingly expendable architectures. Systems that once occupied platforms hundreds of millimetres across now need to fit within the space of a matchbox, operate in GPS-denied environments, withstand extreme mechanical shock, and be produced in quantities that defence procurement models were not designed for—as reflected in the rapid expansion of small, deployable drone systems across modern defence programmes.[26]

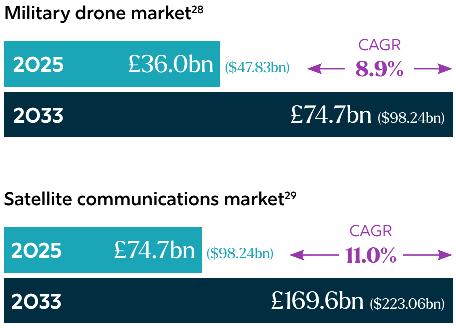
> Defence primes are responding to a shift towards smaller, lighter, and more numerous platforms—measured in grams rather than kilograms. That is driving demand for advanced packaging, and forcing a shift away from ways of working that have been in place for decades.”
>
> **John Boston**
> Managing director, Custom Interconnect Ltd (CIL)

The core microsystems span three interconnected functions: inertial sensing through microfabricated gyroscopes and accelerometers enable positioning when satellite signals are unavailable or jammed; radiofrequency (RF) capability enabled by RF MEMS devices—including reconfigurable antenna systems[27] of the kind developed by Sofant Technologies in Edinburgh—provides radar and secure communications; and advanced packaging brings these functions together within hermetically sealed, thermally managed assemblies that can be deployed in conditions too tough for commercial devices. This marks a fundamental redefinition of how defence capability is realised, one that places a premium on the integration depth that the UK already does well.

The UK's existing base in compound semiconductors, harsh-environment operation, and heterogeneous integration positions it to serve demand across converging defence markets, multiplying the leverage of investment in this technology.

FIGURE 4

Two of defence's fastest-growing markets, drones and satellite communications, are converging on shared microsystems capabilities.



Sources: Grand View Research

2. Supply chain risk is turning sovereign capability into a direct driver of procurement.

Dependence on overseas providers of the microsystems capabilities needed to integrate defence-critical microsystems components—MEMS inertial sensors for GPS-denied navigation, GaN chips for radar, compound semiconductors for secure communications, specialist packaging for electronic warfare systems—has become a strategic liability in an era of supply chain disruption, export controls, and the concentration of advanced fabrication in geopolitically sensitive regions.

In response, the UK's Defence Industrial Strategy (2025)[30] has set sovereign capability as an immediate procurement requirement for key technologies, emphasising the need to strengthen domestic fabrication. Crucially, sovereignty extends beyond access to components and encompasses the knowledge, expertise, and skills to design, fabricate, and sustain these systems over time.

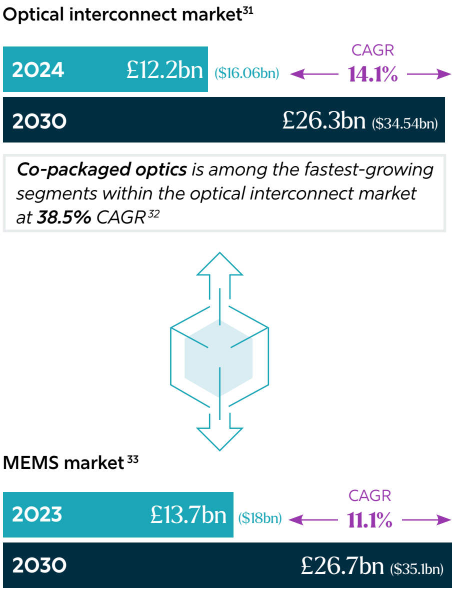
Yet the microsystem technologies that underpin these capabilities is not explicitly defined, despite the depth of microsystem integration-the ability to combine, qualify and sustain components within operational systems—offering a clear pathway to technological sovereignty at the system level. That strategic pathway can be further enhanced by strengthening domestic packaging and heterogeneous integration capabilities, including the infrastructure, skills, and know-how around them. Beyond tighter control and security at the national level, sovereign procurement for microsystems could unlock a distinct market segment for the field's growth that prioritises performance and reliability over unit cost, and operates on timescales long enough to build sustained capability.

AI is pushing beyond compute, and stress-testing everything it depends on

AI is creating a new centre of gravity for microsystems: as models scale, performance is increasingly constrained not by compute alone, but by the connectivity, integration, and sensing capabilities that support both large-scale infrastructure and the deployment of AI in real-world environments.

FIGURE 5

AI is pulling microsystems demand in two directions at once, deeper into data centre infrastructure and further out into the physical world.



***Co-packaged optics** is among the fastest-growing segments within the optical interconnect market at **38.5%** CAGR*[32]

Note: Optical interconnects indicate demand for microsystems integration capabilities, specifically co-packaged optics; they are not classified as a microsystems market.
Sources: Grand View Research

1. Connectivity is increasingly limiting the performance of AI systems at scale.

The growth of AI infrastructure has exposed a physical constraint that was not widely anticipated five years ago: as compute clusters scale, the data volumes flowing between chips have outpaced what conventional electrical connections can carry within an acceptable power budget. The industry response—co-packaged optics,[34] where photonic and electronic chips are integrated into the same package to replace electrical links with light—increases bandwidth and reduces energy per bit, but at the cost of increased integration complexity. The AI connectivity challenge then turns into one of heterogeneous integration: combining components built from different materials, fabricated through different processes, and operating across different physical domains within a single, precisely assembled unit while managing thermal loads, signal integrity, and reliability across interfaces.

As hyperscalers project a sixfold increase in internal data-centre traffic within five years,[35] demand for these microsystems-enabled architectures is scaling rapidly, within an optical interconnect market on course to double by 2030.[36] This capability is already being developed in the UK by firms such as Bay Photonics, whose Innovate UK-supported work in adjacent domains[37] addresses closely related integration challenges required for AI systems.

> If you look at the national funding landscape, the UK tends to favour AI applications at one end and materials discovery at the other, effectively cutting out the microelectronics and semiconductor systems in the middle—creating a dearth in that enabling layer, with funding arriving only episodically and often driven by application fashions.”

John Goodenough
Professor of microelectronic systems, University of Sheffield

As the UK pursues sovereign AI, policy efforts and investment have focused primarily on domestic compute. While companies such as Fractile are expanding UK-based chip design activity,[38] compute alone is not the bottleneck: the long-term impact of these efforts will depend on complementary investment in the packaging, integration, and sensing capabilities that determine how AI systems actually perform at scale.

2. AI is expanding into the physical world through sensing and edge systems.

The demand AI creates for microsystems extends well beyond data centres and chip packaging. As AI capability moves towards the edge—into vehicles, industrial systems, medical devices, and distributed networks—demand for sensors, actuators, and integrated systems that connect physical environments to AI processing expands in parallel. MEMS inertial sensors, MEMS timing devices and micro-optical scanning systems provide the environmental awareness edge AI requires; lab-on-chip biosensors are bringing clinical-grade measurement into wearables and implantables; miniaturised gas and flow sensors are enabling the environmental awareness that edge AI requires across industrial and healthcare applications. In each case, the microsystem is central to the AI application, forming the physical interface through which AI engages with the world.

This convergence is underpinned by a global MEMS market[39] now comparable in scale to optical interconnect infrastructure, with the fastest growth in LIDAR, industrial automation, smart infrastructure, and environmental monitoring—applications built on the same core fabrication and integration capabilities. Global industry leaders are already positioning around this layer: Bosch Sensortec is moving intelligence into the sensor itself, launching its 2026 BMI5 AI MEMS motion-sensing platform[40] for robotics, XR and wearables; Microchip Technology is turning edge microcontrollers and microprocessors into local AI-inference platforms;[41] and UK startup Intrinsic Semiconductor is tackling the memory bottleneck with RRAM for edge AI,[42] designed to bring non-volatile storage directly onto advanced processor chips. For UK companies operating at this layer, AI's expansion into the physical world is not a downstream application trend but a direct demand signal for the devices they already know how to make.

> One of these days, we are going to hit the von Neumann bottleneck —so the need for new materials and architectures. The next generation of compute is starting to emerge, and a lot of this is going to come from heterogeneous integration: having a fully functional system built on a single chip will be the way things will eventually go.”

Iain Mauchline
Head of semiconductors and innovation lead for electronics, sensors and photonics, Innovate UK

Rapid electrification is redefining how power is generated, managed, and delivered

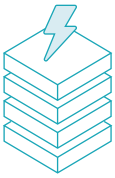
Rapid electrification is reconfiguring energy systems across transport and grid infrastructure, creating new demands on power electronics that conventional silicon is increasingly unable to meet.

FIGURE 6

As electrification reshapes energy from source to socket, microsystems are needed at every stage—from the components handling power conversion to the sensors managing a grid that never sleeps.

Power electronics market[43]

GaN[44] and SiC[45] semiconductor devices are among the fastest-growing segments within the power electronics market projected to reach £17.4bn ($22.9bn) by 2030 at a blended CAGR of ***~25%***



Printed electronics market[46]

Note: GaN and SiCs figures indicate demand for microsystems fabrication capabilities, specifically shared thin-film deposition, etching, and advanced packaging infrastructure; they are not classified as a microsystems market.
Sources: Grand View Research

1. Power conversion is pushing beyond the limits of conventional silicon.

At high voltages, elevated temperatures, and fast switching speeds, silicon devices become less efficient and harder to manage thermally, constraining performance where efficiency and power density matter most.

Wide-bandgap semiconductors[47] address these constraints by enabling faster switching, higher power density, and improved thermal performance across EVs, charging systems, and grid infrastructure. While these are semiconductor materials, deploying them in real systems with high performance depends on microsystems capabilities: advanced packaging, microfluidic thermal management, MEMS-based sensing integrated within power modules, and the system-level integration that compresses high-performance power conversion into the compact form factors that EVs, industrial automation, and distributed energy infrastructure demand—with SiC and GaN power-device technologies enabled by Oxford Instruments' fabrication technology[48] as a notable example.

The transition away from conventional silicon power devices is accelerating rapidly: demand for GaN and SiC power semiconductors is set to grow strongly over the coming decade, driven by electrified transport and energy systems, within a global power electronics market[49] underpinning electric vehicles, renewable energy, and grid infrastructure measured in the tens of billions. Capturing a share of this opportunity requires investment in the advanced fabrication, packaging, and system integration that wide-bandgap devices depend on, precisely the microsystems infrastructure through which the UK is best positioned to compete.

2. Energy infrastructure is becoming distributed, long-lived, and data-driven.

Electrified energy systems are shifting from centralised generation and passive distribution towards geographically distributed networks of assets—wind farms, solar arrays, storage systems, and smart grids—that must operate autonomously and coordinate in real time. This increases system complexity and places new demands on continuous monitoring, local decision-making, and long-term reliability, often in environments where maintenance is difficult and infrastructure must operate for decades.

Meeting these requirements depends on embedding sensing, power, and control directly within infrastructure. Microsystems enable this by integrating sensors, energy harvesting, communication, and computation into compact, self-contained systems that can operate without external power or regular maintenance. MEMS-based energy harvesters[50] convert ambient vibration or thermal gradients into electrical power for autonomous sensing,[51] while printed and large-area electronics extend sensing and control across surfaces and structures—enabling low-cost deployment at the scale required for distributed energy systems, particularly in renewable integration and electrified transport. Delivering these capabilities requires sensing, power, and control to be co-designed and integrated within robust, long-lived systems operating under variable conditions.

The demand this creates is substantial, within a printed electronics market set to grow fivefold by 2033,[52] as distributed infrastructure demands sensing at a scale only large-area fabrication can deliver. The UK has distinctive capability here: the National Centre for Printed Electronics at CPI[53]—part of the High Value Manufacturing Catapult—is extending large-area fabrication into printed sensors and distributed electronic systems, while innovative semiconductor companies are already deploying ultra-low-cost sensing and electronic devices at scale[54] across diverse infrastructure and assets.

The economic contribution of the UK microsystems base

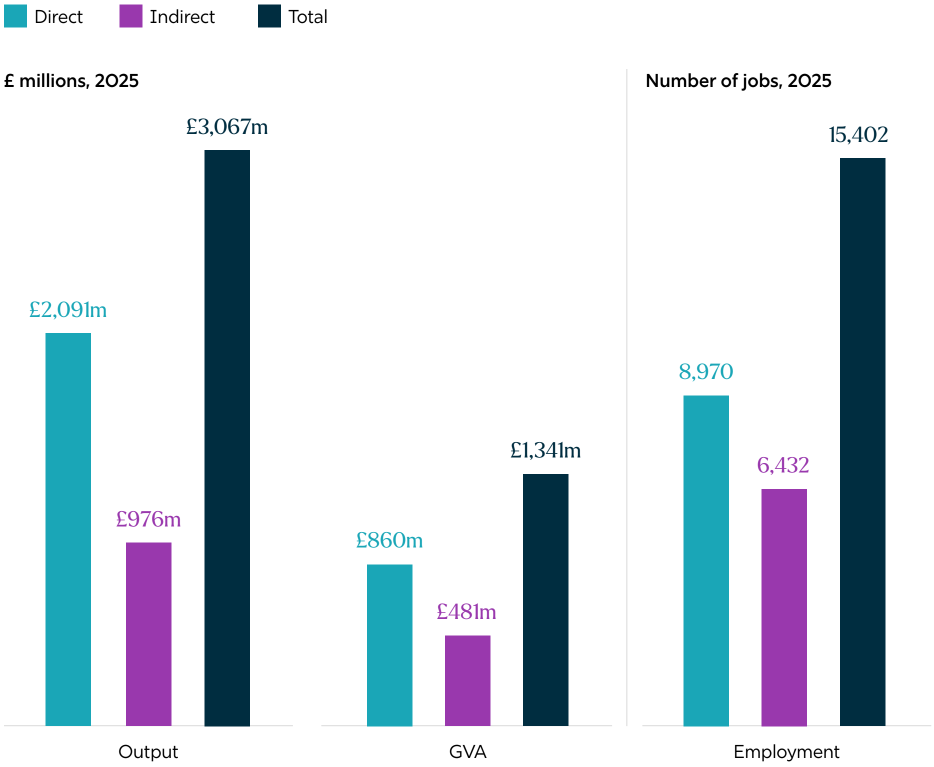
The economic significance of the UK microsystems sector has long been underappreciated: embedded within the products, systems and applications it enables, rather than recognised as a distinct industrial activity, its contribution to the UK economy has never been quantified. This study presents the first comprehensive assessment of the UK microsystems sector's contribution to the national economy, applying an economic impact framework (full methodology in Appendix B. Measuring the UK microsystems base) to measure activity both within microsystems firms and across their supply chains.

This analysis finds that the UK microsystems sector generates a total economic footprint of £3.1 billion in output and £1.3 billion in GVA in 2025 (or per year), sustaining more than 15,000 jobs across the economy once supply chain and indirect effects are accounted for.

In aggregate, these figures establish microsystems as a sector that, while modest in size, is a materially significant contributor to the UK's advanced manufacturing base, geographically concentrated, and deeply embedded in strategically important supply chains.

FIGURE 7

The UK microsystems sector's £3.1 billion economic footprint, broken down across direct firm activity, supply chain effects, and total impact.



Sources: ONS, Type Ventures

A high-value sector, punching above its weight

Microsystems companies generated a direct output of £2.1 billion and contributed approximately £860 million to UK GVA in 2025, directly supporting 8,970 jobs across the country. Taken alone, these figures are notable for a sector that operates largely beneath public and policy awareness; their significance becomes evident when considered alongside the productivity of the underlying activity.

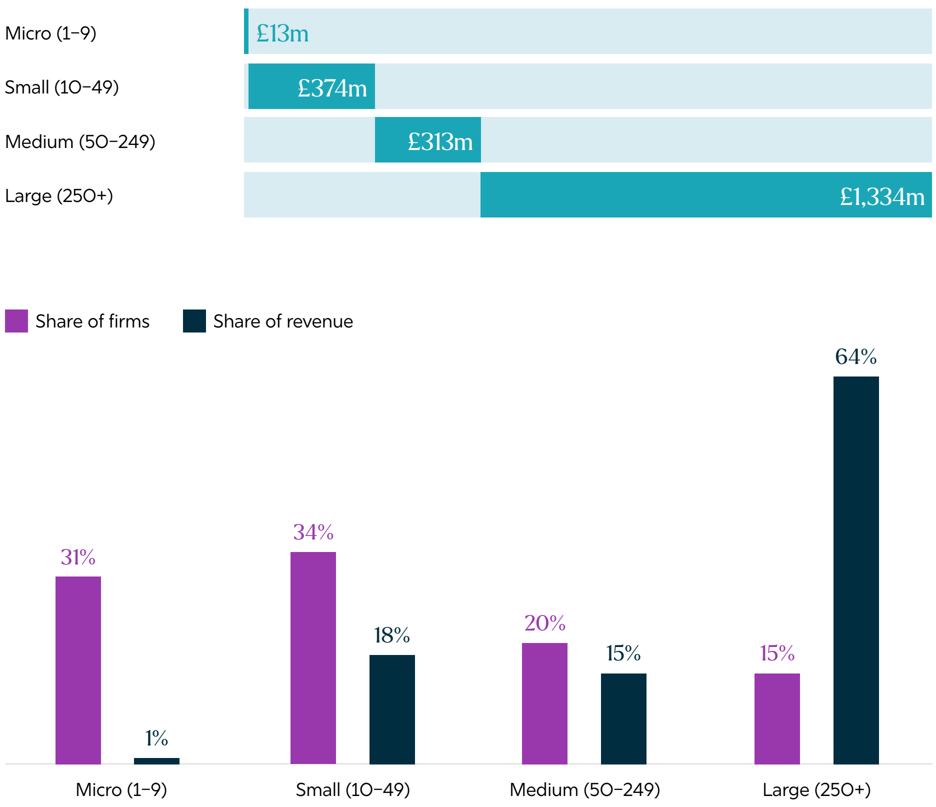
At the level of the individual firm, microsystems activity is associated with consistently high value creation. The average worker employed within a UK microsystems company generated £95,881 of gross value added in 2025—a rate 26% above the UK median productivity[55] and 3% above the UK manufacturing sector average.[56] This is a level of productivity typically associated with the most advanced sectors within the economy, reflecting the technical nature of microsystems manufacturing.

The distribution of this value across firms reveals a sector dominated by small and micro firms, which account for 63% of all UK microsystems companies. Yet the majority of economic output—over 64% of total sector turnover—is concentrated in the largest firms, which operate at a scale sufficient to sustain advanced fabrication, packaging, and integration capability. What emerges is a tightly coupled structure: a wide ecosystem of highly specialised firms feeding into, and supported by, a smaller set of scaled manufacturers capable of translating technical capability into industrial output.

This concentration of output within a long tail of smaller firms points directly to the scale-up opportunity explored in Part III—Funding: Unlocking the journey from discovery to scale: where microsystems firms are able to reach scale, they sustain advanced capabilities and capture a disproportionate share of economic value.

FIGURE 8

A small number of large firms account for a disproportionate share of total activity, while most firms operate at a much smaller scale.



Sources: The Data City, Type Ventures

Concentrated in clusters, with opportunity to broaden impact

UK microsystems activity is concentrated geographically, with over 45% of firms located in the East and Southeast of England, clustering around established technology ecosystems in and around Cambridge, Oxford, and Southampton. This pattern reflects the co-location dynamics associated with advanced technology sectors, where proximity to research institutions, specialised labour markets, and complementary firms reinforces cluster development over time.

The Southeast alone accounts for £876 million in output—44% of the national total—and 3,241 direct jobs, making it the dominant region by a substantial margin. The East of England is the second-largest hub, generating £385 million in output and supporting 1,433 jobs. Together, these regions make up 63% of total sector output, with an even larger share of employment when adjacent regions are included.

In this picture, Scotland exhibits a unique profile, combining a relatively modest scale—£42.3 million in output and 246 jobs—with the fourth-highest GVA per employee (£91,217) among UK regions. This indicates a concentration in higher-value, lower-volume activity, supported by institutions such as the James Watt Nanofabrication Centre in Glasgow[57] and the Scottish Microelectronics Centre in Edinburgh.[58]

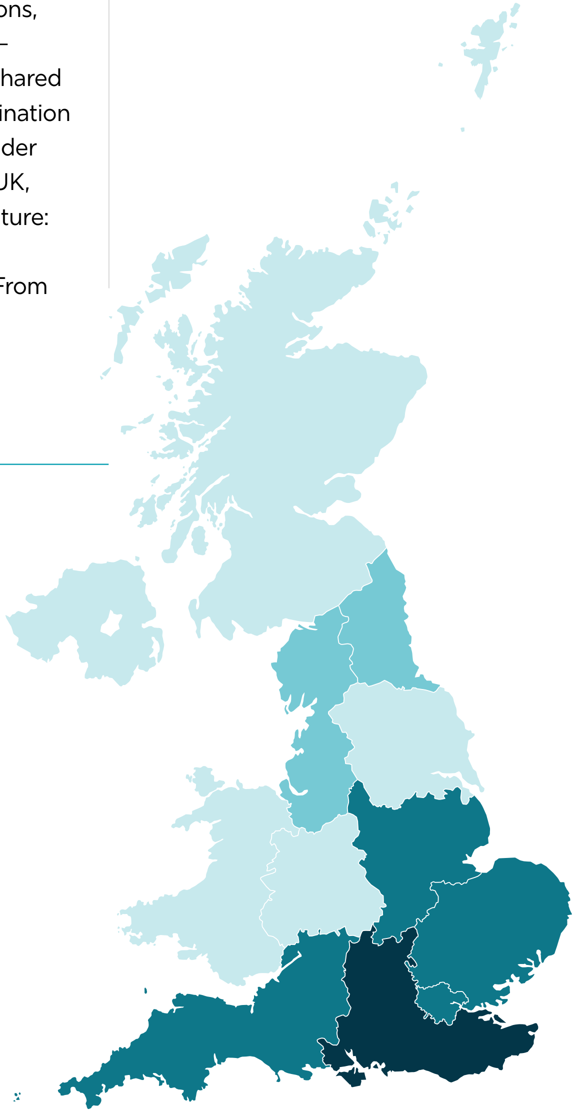
Collectively, these regional patterns indicate a sector in which capability is concentrated in a relatively small number of locations, each combining research strength, specialised skills, and industrial capacity. This concentration underpins the sector's ability to sustain high-value activity, but also shapes how that capability can grow. Where capability is anchored in a limited number of clusters, its development becomes closely tied to the strength and continuity of specific institutions, firms, and research programmes—underscoring the importance of shared infrastructure and effective coordination mechanisms in supporting a broader diffusion of capability across the UK, as explored in Part III—Infrastructure: Sharing capability in a distributed field and Part III—Coordination: From activity to ecosystem alignment.

FIGURE 9

Employment is highly concentrated in a small number of regions, particularly in the South and East of England.

Number of jobs

- ■ >2,000
- ■ >1,000
- ■ >500
- ■ >250
- ■ ≤250



Sources: The Data City, Companies House, Type Ventures

Embedded in supply chains that serve strategic sectors

The sector's economic contribution extends well beyond direct impacts. Microsystems companies rely on a complex network of domestic supply chains spanning raw materials, fabrication equipment, specialist components, logistics and professional services. Through their supplier network, microsystems companies support up to 6,432 jobs across the UK, contributing an additional £480 million to the UK economy in 2025. The resulting supply chain multiplier implies that every 10 jobs within microsystems supports a further 7 elsewhere in the UK economy, placing once again microsystems alongside high-value advanced manufacturing sub-sectors.

Crucially, microsystems firms also operate as upstream enablers across several strategically important sectors at the core of the UK government's industrial strategy:[59] defence and national security,[60] where advanced packaging, inertial sensing, and integrated compound semiconductor devices underpin sovereign capability in navigation, communications, and electronic warfare; life sciences,[61] where microfluidic diagnostics, organ-on-a-chip platforms, and implantable devices are reshaping pharmaceutical development and clinical care; digital infrastructure and AI,[62] where co-packaged optics and edge sensing depend directly on the fabrication, modeling, design and packaging capabilities the sector already provides; and advanced manufacturing,[63] where precision sensing, power electronics, and heterogeneous integration are enabling the electrification and automation of industrial systems at scale. These interdependencies position microsystems as a foundational technology across multiple priority sectors of the UK economy, linking component-level innovation to system-level capability and deployment.

In its role within supply chains and as a downstream enabler, microsystems acts as a point of leverage in the UK economy: disruption to the domestic base would have effects well beyond what its modest size might suggest. Strengthening this base through a coherent national strategy would generate returns across frontier sectors—making the talent, funding, and infrastructure investments explored in Part III—Rising to the moment a multiplier rather than marginal bet: each intervention compounds in value because the capability it supports sits at the centre of multiple converging global demand signals.

CASE STUDY

Custom Interconnect Ltd: A microsystems growth story

The UK's largest outsourced semiconductor assembly and test facility,[64] Custom Interconnect Ltd (CIL), has grown at up to 40% annually over the last five years—far exceeding the microsystems base's estimated 8.6% annual growth rate and well above global semiconductor benchmarks[65]—highlighting the intensity of demand in this segment of the value chain.

CIL operates downstream in the manufacturing value chain: in packaging, integration, and system-level assembly, where components are combined into deployable products. From its 80,000+ square-foot facility and with a 200-strong workforce, CIL integrates semiconductor packaging[66] with contract electronics manufacturing,[67] enabling devices to move from wafer-level inputs through to fully assembled electronic systems within a single site, reducing supply chain complexity and integration risk. The same model is directly relevant to microsystems, where packaging complexity and cost concentration are even greater.

End-user applications are diverse, from defence primes to automotive and edge AI. But in areas like packaging and testing, the intellectual property resides with the customer: non-disclosure agreements (NDAs) prevent companies like CIL from naming clients, describing applications, or publicising results. As John Boston, managing director of CIL, notes: "What people think is happening in the UK and what's actually happening aren't the same. […] From the outside, you would almost think nothing is going on, because nobody is publicising it." But, as Boston points out, the reality becomes more visible when examining sustained annual turnover increases: tripling from £15.0 million in 2021 to £45 million in 2026, and with projections indicating more than £80 million in 2027.

Unlike other parts of the manufacturing value chain, and across the microsystems sector more broadly, there are few outward signals—no product announcements, no attributable end-products, and limited public documentation. As a result, a significant portion of the UK's advanced manufacturing capability remains largely unseen in the public eye.

The UK's international position: advantage through specialisation

Microsystems capability is becoming a strategic priority across every major economy. The infrastructure investments being made now in fabrication, packaging, and integration will determine who captures value from the frontier technologies reshaping the global economy.

A global race on its own terms

The global competition for the fabrication, packaging, and integration capabilities that underpin microsystems—albeit rarely named as such in national strategies, but embedded within semiconductor, advanced manufacturing, and frontier technology programmes worldwide—is shaped by the very different starting points of major actors, in both policy and existing capabilities.

East Asia competes on ecosystem density:

Taiwan and South Korea—and, in complementary roles, Japan's materials and equipment base—have spent decades building tightly co-located industrial systems[68] of fabs, materials suppliers, equipment vendors, and process engineering talent. These ecosystems generate cumulative efficiencies in faster iteration, lower operating costs, and deep reservoirs of tacit knowledge that reinforce over time. This density, however, also creates structural interdependence, making large-scale reconfiguration capital-intensive and path-dependent as technologies, architectures, or supply chain requirements shift.

The United States competes on capital mobilisation:

American policy has focused on deploying public funding at sufficient scale to catalyse private investment and reconstitute domestic capability across the semiconductor stack. The CHIPS and Science Act[69] exemplifies this approach, directing tens of billions of dollars towards fabrication, advanced packaging, and R&D, with firms such as Intel[70] and Amkor Technology[71] expanding domestic capacity. Yet capital alone cannot subsidise embedded expertise and supplier networks, as evidenced by the persistently higher operating costs in US-based facilities,[72] even as Taiwan remains ahead at the technology frontier.[73]

Europe competes as a coordinated bloc:

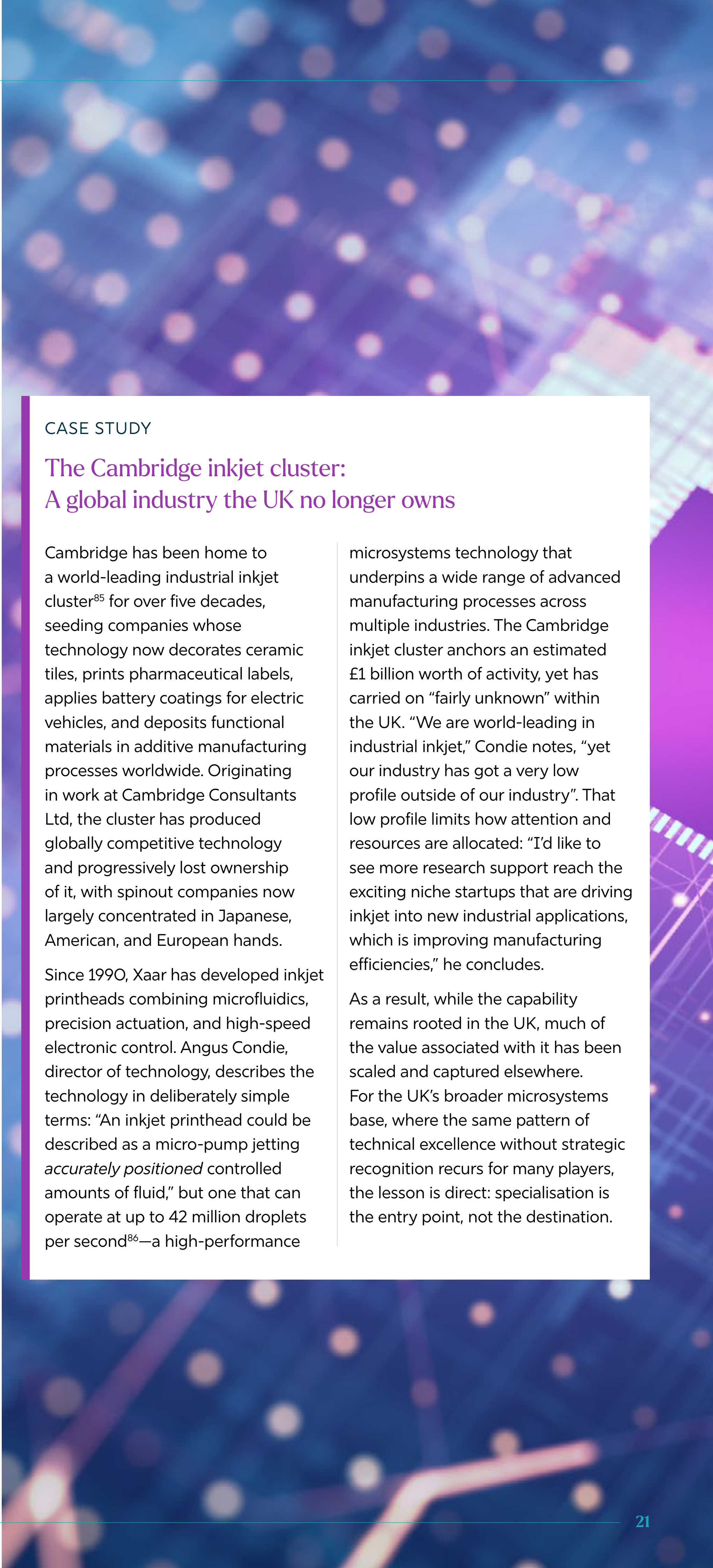
By pooling investment across member states, the EU can operate at a scale none of its countries could sustain individually. Shared R&D programmes and distributed infrastructure enable participation: the European Chips Act, used here on the same basis as the US example, has catalysed €69 billion across R&D and facility investment,[74] including the APECS pilot line[75] dedicated specifically to advanced packaging and heterogeneous integration—with Chips Act 2.0 in legislative proposal[76] as of Q1 2026. While achieving scale, this approach comes at the cost of concentration as distributing capability geographically limits the formation of dense industrial clusters, diluting some of the cumulative advantages seen in more centralised systems.

Canada competes on open-access infrastructure:

CMC Microsystems[77]—a national not-for-profit that has provided shared design tools, EDA software, and fabrication access to researchers and companies since 1983—gives to microsystems in Canada something most comparable economies lack: a named institutional home with four decades of continuity. Canada's FABrIC programme[78] builds on this foundation with a distinctive four-pillar strategy covering MEMS alongside compound semiconductors, photonics, and quantum, anchored by C2MI's[79] manufacturing infrastructure in advanced packaging and MEMS in Bromont—the only non-US facility qualified under the US Department of Defense's Trusted Foundry Program,[80] as of 2024—and extended internationally through bilateral partnerships with allied economies. The result is an ecosystem where a middle power has used coordination and openness to build international relevance without competing on fabrication scale.

The UK competes on independent agility.

Rather than competing at the scale of the largest actors, the UK's advantage lies in its ability to focus on strategically chosen domains and embed them within global value chains, as reassociation to Horizon Europe,[81] alongside bilateral cooperation with partners such as the United States,[82] Canada[83] and Japan,[84] allows UK actors to operate within larger innovation systems. In this context, the UK trades breadth for precision: competitive advantage depends on identifying and reinforcing domains where the UK edge outweighs the benefits of scale manufacturing.



> Where we've lost ground, it's difficult to recover, as they tend to be areas requiring large capital investments. Once an investment has been made, it's often too late to catch up."

Andy Sellars
Semiconductor industry advisor and chair of the semiconductor expert working group, UKTIN

CASE STUDY

The Cambridge inkjet cluster: A global industry the UK no longer owns

Cambridge has been home to a world-leading industrial inkjet cluster[85] for over five decades, seeding companies whose technology now decorates ceramic tiles, prints pharmaceutical labels, applies battery coatings for electric vehicles, and deposits functional materials in additive manufacturing processes worldwide. Originating in work at Cambridge Consultants Ltd, the cluster has produced globally competitive technology and progressively lost ownership of it, with spinout companies now largely concentrated in Japanese, American, and European hands.

Since 1990, Xaar has developed inkjet printheads combining microfluidics, precision actuation, and high-speed electronic control. Angus Condie, director of technology, describes the technology in deliberately simple terms: "An inkjet printhead could be described as a micro-pump jetting *accurately positioned* controlled amounts of fluid," but one that can operate at up to 42 million droplets per second[86]—a high-performance microsystems technology that underpins a wide range of advanced manufacturing processes across multiple industries. The Cambridge inkjet cluster anchors an estimated £1 billion worth of activity, yet has carried on "fairly unknown" within the UK. "We are world-leading in industrial inkjet," Condie notes, "yet our industry has got a very low profile outside of our industry". That low profile limits how attention and resources are allocated: "I'd like to see more research support reach the exciting niche startups that are driving inkjet into new industrial applications, which is improving manufacturing efficiencies," he concludes.

As a result, while the capability remains rooted in the UK, much of the value associated with it has been scaled and captured elsewhere. For the UK's broader microsystems base, where the same pattern of technical excellence without strategic recognition recurs for many players, the lesson is direct: specialisation is the entry point, not the destination.

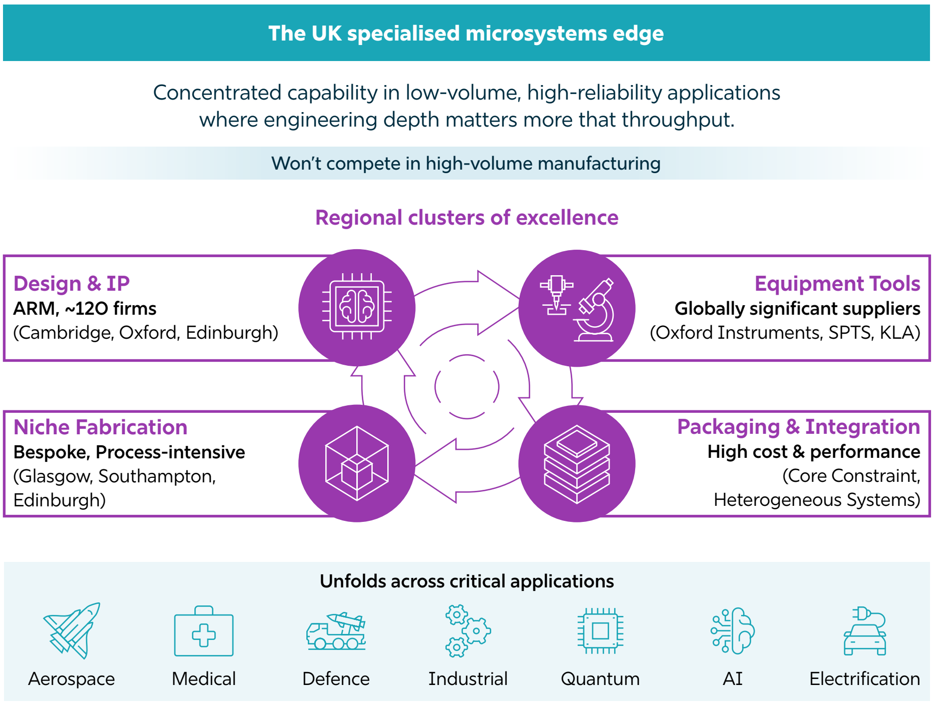
The UK edge: niche and specialised

Rather than being evenly distributed across the field, the UK's microsystems capability is concentrated in specific layers of the value chain, built through decades of work where engineering depth, precision, and cross-domain integration outweigh the advantages of scale and throughput.

> When promoting the UK to international clients, [I find that talking in generalities doesn't work], I try to understand their specific needs and then identify specifically relevant UK capability."
>
> **Philip White**
> Technology specialist,
> Department for Business and Trade

FIGURE 10

The UK microsystems profile is defined by a concentrated specialisation in high-reliability engineering, leveraging regional clusters to deliver system-level integration for critical and emerging applications.



At the fabrication layer, the UK maintains a set of specialist facilities including the James Watt Nanofabrication Centre in Glasgow,[87] the Southampton Nanofabrication Centre[88] (alongside its advanced E-beam lithography capability),[89] and the Scottish Microelectronics Centre in Edinburgh,[90] all of which retain world-class capability in niche micro- and nano-scale device fabrication for various applications—even as volume manufacturing has moved offshore. These capabilities are embedded within regional clusters—including the Central Belt of Scotland, Cambridge, South Wales, and Southampton—where university research, infrastructure, and commercial activity co-locate. Open-access fabrication models are beginning to extend this capability to a broader user base, with the proposed MICROCRAFT platform being developed between Southampton and Bristol,[91] in partnership with Siemens Cre8Ventures[92]—building on the model demonstrated by Cornerstone in photonics[93]—set to enable incipient pathways from research to early-stage commercialisation by offering a technology development platform for micro- and nano-electromechanical systems—MEMS and NEMS—via shared wafer runs, design enablement, process development, and skills training at the system level for researchers, startups, and companies across the UK.

At the packaging and integration layer, the UK holds established expertise in heterogeneous integration systems across materials, processes, and physical domains—particularly in sectors such as aerospace, defence, and high-reliability sensing, where performance requirements exceed those of consumer electronics. In heterogeneous integration, the primary challenge shifts from individual components that can be fabricated from different materials and processes towards combining these disparate technologies into a single system that operates as one unit. Here is also where a significant share of microsystems value resides: reflecting the underlying manufacturing process challenges for MEMS,[94] packaging in MEMS can account for up to 80% of total device cost according to industry insights—concentrating both economic value and technical dependency at this stage of the supply chain. The recently established CHIMES Innovation and Knowledge Centre (IKC) is building on this foundation, providing a research and coordination anchor for heterogeneous integration that brings together industry and academia across nine UK institutions.

At the design and IP layer, the UK occupies a globally significant position, anchored by leadership in processor architectures providing a critical enabling layer for on-device intelligence—notably the global adoption of Arm-based designs[95] in mobile and embedded computing—and a broader ecosystem of design-led innovation and IP aligned with the global shift towards fabless and application-specific models.[96] Across the UK, microsystems design activity spans areas including integrated sensing systems, MEMS devices, microfluidic platforms, and microsystems packaging, with Cambridge a leading hub for integrated system innovation, supported by strong spin-out activity and cross-sector collaboration. Much of this activity is closely coupled with real-world system requirements in high-value sectors—for example, sensing innovator Flusso Limited develops ultra-miniaturised flow and gas sensors[97] for industrial and healthcare applications, while specialist Owlstone Medical uses chemical-sensing technologies to detect and analyse compounds[98] across environmental, defence, and healthcare applications.

At the equipment and enabling supply chain layer, the UK is anchored by globally significant suppliers including Oxford Instruments,[99] a specialist in plasma, cryogenic, and quantum-enabling instrumentation; IQE,[100] a global leader in advanced compound semiconductor epitaxy for RF, photonics, and power devices; and SPTS Technologies,[101] a UK-founded provider of etch and deposition tools for MEMS and advanced packaging, acquired by leading US-based system supplier KLA Corporation in 2019.[102] This presence anchors process engineering expertise in the UK and connects domestic capability to the leading edge of microsystems fabrication technology without the capital intensity associated with full-stack manufacturing. Recent investment, including KLA's major R&D and manufacturing facility in Newport, Wales,[103] reflects continued global demand for advanced microsystems manufacturing capabilities and reinforces the UK's role in the equipment supply chain.

Taken together: These layers describe a capability profile aligned with where value in microsystems is concentrating: integration, packaging, and specialised engineering that unlock system-level integration for frontier applications.

CASE STUDY

Silicon Sensing: Precision performance in extreme environments

A pea-sized gyroscope that maintains navigation-grade accuracy through shock, vibration, and temperature variation underscores a core strength of the UK's microsystems base: the ability to design and manufacture devices that maintain performance in conditions that quickly erode standard components.

Headquartered in Plymouth, Devon, Silicon Sensing has been developing and manufacturing precision MEMS inertial sensors since 1999, when it was formed as a joint venture between BAE Systems—drawing on a gyroscope heritage stretching back to the Sperry Gyroscope Company founded in 1913[104] —and Sumitomo Precision Products of Japan. Now jointly owned by American aviation company Collins Aerospace and Sumitomo, the company achieved a landmark milestone in 2025: supplying more than 30 million inertial sensors worldwide,[105] with many still in active service after two decades of continuous operation, and recording sales growth of over 65%[106] in five years.

The central sensing element in its inertial sensors is the gyroscope, which is built around a microfabricated silicon ring driven to vibrate at a stable frequency. When the device rotates, the Coriolis force, which deflects motion sideways in a rotating system, shifts the ring's vibration pattern in proportion to the rate of turn; onboard electronics detect that shift and convert it into an angular rate measurement accurate enough for navigation without any external reference. The ring's symmetrical geometry,[107] a result of tight fabrication tolerances maintained in Silicon Sensing's own in-house MEMS foundry, gives it inherent resistance to the acceleration-induced errors and thermal drift that disqualify most MEMS devices from high-reliability applications. The sensing element, control electronics, and packaging are integrated into a compact, sealed microsystem.

The applications it enables illustrate what bespoke, harsh-environment capability actually means in practice: guiding underwater vehicles without GPS, stabilising satellites over multi-year missions, and supporting the MMX rover on Phobos, where surface conditions remain uncertain—all before the recent announcement of a new tactical-grade, north-seeking MEMS gyroscope[108] that can deliver navigation-grade performance without GPS or magnetic signals, a capability that until recently required much larger and more expensive systems.

This is the direction of travel: capabilities once confined to bulky specialist hardware are now being delivered in miniature, reshaping how advanced systems are designed and deployed. Silicon Sensing exemplifies a distinctive UK strength in this transition—the ability to design and manufacture highly reliable, high-performance microsystems for the most demanding environments. That it exists, and is growing, in Plymouth is not incidental; it is a direct expression of what the UK's microsystems base, when properly supported, can produce.

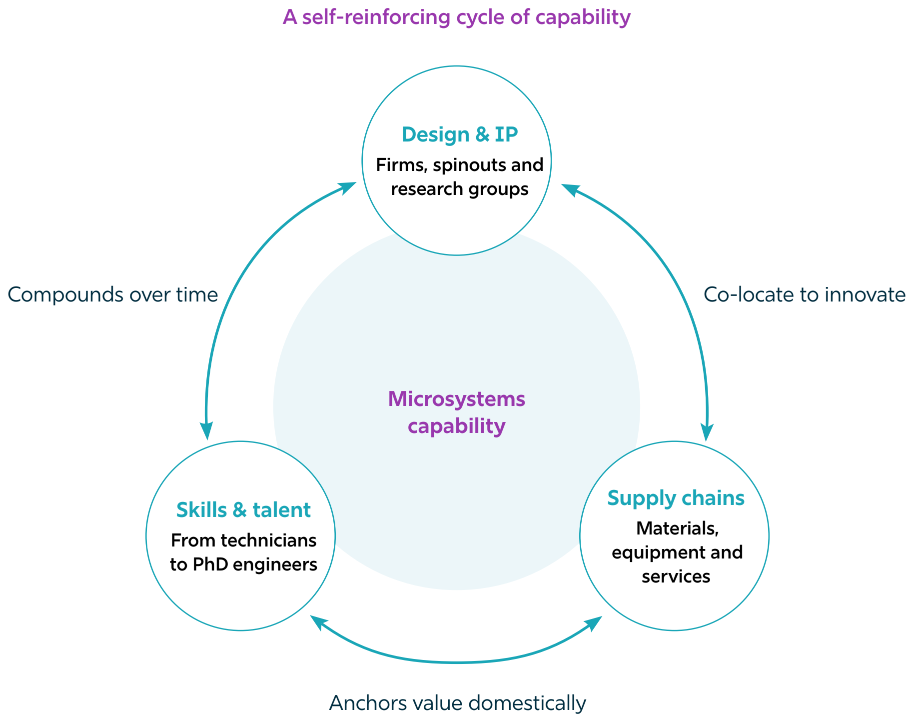
What will be won, lost, or decided now

Strategic windows in advanced technology can close, whether through drift or disruption. For the UK, "designed here, built elsewhere" is a pragmatic strategy because volume fabrication will concentrate where scale is cheapest. What the UK cannot afford to offshore is control of the high-value layers—advanced packaging, specialised fabrication, and the bespoke device engineering that serves applications where reliability and integration depth outweigh unit economics.

The markets outlined above are already contested, and the decisions made over the coming years will determine where the UK wins, where it loses ground, and where capability slips permanently out of reach. Below, we analyse its position today: areas of established strength sitting alongside narrowing opportunities and at least one recent loss of capability. This is not an exhaustive audit of where the UK stands across every microsystems sub-field; it is an assessment of the most significant strategic windows that the research and interviews surfaced, presented to illustrate the range of what is being decided now.

FIGURE 11

Once established, microsystems capabilities tend to anchor surrounding activity, including supply chains, skills, and system design.



A window once closed, being reopened

The UK has lost one piece of microsystems capability that is difficult to replace when Semefab—the country's original volume MEMS foundry—closed its 4-inch Fab 1 in 2022.[109] While its remaining foundry platforms[110] continue to support both MEMS and CMOS/Bipolar production, Semefab remains the only dedicated open-access volume MEMS foundry in the UK. The closure of its Fab 1 narrowed an already thin domestic foundry option set, limiting the range of devices that can be developed and manufactured domestically.

The effect is amplified by the absence of a scaled open-access MEMS foundry equivalent to Silex Microsystems[111]—the world's leading pure-play MEMS foundry, headquartered in Sweden and valued at SEK 5.5 billion (£400 million) in July 2025.[112] A shared facility of this scale allows smaller firms to iterate, de-risk designs, and move towards production without committing to full in-house fabrication. Where that capability is missing, companies depend earlier on overseas foundries, shifting control over timelines, process access, and ultimately product evolution beyond the domestic ecosystem.

Furthermore, consolidation within the European MEMS ecosystem—illustrated by leading European group STMicroelectronics' acquisition of the MEMS sensor business of Netherlands-headquartered NXP Semiconductors[113]—is concentrating manufacturing scale and influence within a smaller set of actors. The UK is largely outside this process, which limits its ability to shape capacity allocation, technical standards, and future process roadmaps.

For the UK, the connection between design and manufacturing has weakened, and it is at that interface that microsystems expertise becomes embedded, scaled, and retained over time; once that link thins, rebuilding it requires deliberate reinvestment on timescales far longer than those over which it was lost—an investment that the UK could make through MICROCRAFT[114], the proposed national platform for MEMS and NEMS currently looking for dedicated funding to restore the missing design-to-fabrication link.

The two technologies serve different strategic purposes: MEMS restores a fabrication capability the UK has lost ground in; NEMS opens genuinely new territory, as the natural successor technology underpinning quantum sensing, AI-edge computing, and next-generation defence applications—domains where the competitive window is still open, and the UK's research base is strong. Beyond shared cleanroom access, MICROCRAFT is designed as a facility where new microsystems technologies can be developed, matured, and manufactured at scale and high yield, rather than prototyped domestically and offshored at the point of commercial realisation. Already providing early custom fabrication services from the Zepler Cleanrooms[115]—one of Europe's most advanced fabrication environments—MICROCRAFT could scale into a full national platform with sustained support, bridging the competitive distance to platforms such as Silex Microsystems and restoring the design-to-fabrication link that anchors expertise, talent, and commercial value within the UK.

A window at risk of closing

As packaging complexity rises, participation depends less on individual technical capability and more on the ability to design, prototype, and qualify systems within open-access environments. For the UK, the opportunity to establish a leading position in heterogeneous integration and advanced packaging at the device level remains open, albeit increasingly limited by the absence of shared infrastructure needed to translate emerging research capability into prototyping and pre-production activity at scale.

That enabling layer is being built by competitors with scale and coordination: the EU's APECS pilot line,[116] coordinated by Fraunhofer and including Imec and CEA-Leti, is now operational and specifically dedicated to advanced packaging and heterogeneous integration; Singapore's A*STAR is also building a National Co-Innovation Fab[117] with the same focus; and the US CHIPS Act explicitly funds advanced packaging capacity.[118] The UK enters this landscape with credible engineering capability—through Custom Interconnect Ltd, specialist firms, and research groups—and with the new CHIMES Innovation and Knowledge Centre[119] providing a research and coordination anchor for heterogeneous integration at the Proof-of-Concept (PoC) level, but without a comparable production-level infrastructure programme and with a documented skill shortage further slowing adoption of 2.5D and 3D integration.[120]

Gaps in scale, capital, and talent retention compound over time, as infrastructure anchors both development activity and the skills base that sustains it. The structure of the advanced packaging market already reflects this dynamic: projected to reach around £42 billion ($55 billion) by 2030,[121] but with capacity heavily concentrated in Asia-Pacific and expanding in the US through a wave of large-scale investment by leading players including TSMC (Taiwan), ASE (Singapore), Samsung (South Korea), JCET (China), and Amkor (US). As development in advanced packaging becomes more firmly anchored outside the UK, so too does influence over integration choices, timelines, and system architectures.

Windows to open

The windows where the UK holds meaningful opportunity in microsystems map closely onto the four demand signals described earlier from the high-growth sectors—not by coincidence, but because those are precisely the areas where the market depends on integration depth, reliability, and application-specific design rather than manufacturing scale, where existing UK capability retains relevance.

1. **In life sciences**, the expansion of NHS Community Diagnostic Centres,[122] alongside a £700 million procurement framework for diagnostic solutions[123] established in August 2025, is creating a structured domestic pathway for devices that integrate microfluidic handling, biosensing, signal processing, and control within compact clinical platforms. Beyond being a market, the NHS acts as a clinically grounded testbed,[124] creating an underexplored opportunity for microsystems companies such as CN Bio and Emulate Bio to iterate and validate within real care pathways before scaling internationally. What emerges is a rare alignment of procurement, validation, and deployment within a single system that is difficult to replicate elsewhere—giving UK-based development a competitive degree of continuity from prototype to adoption in applications where critical healthtech increasingly depends on microsystems.
2. **In defence**, demand for high-reliability microsystems for drone positioning, navigation and timing (PNT) and communications is growing for every major military force. As the UK procurement framework shifts towards autonomy,[125] performance requirements increasingly favour bespoke design, long-term reliability, and tolerance to extreme conditions. These characteristics are difficult to source through volume commercial supply chains, reinforcing the relevance of existing UK expertise—reflected in firms such as Silicon Sensing Systems and Custom Interconnect Ltd, where capability is sustained through a combination of long-standing defence demand and participation in publicly supported development programmes. This is the kind of dedicated field-level support that compound semiconductors have secured through programmes such as the GanSIC project,[126] demonstrating the model through which microsystems defence capability could be similarly anchored and sustained.
3. **In digital infrastructure**, microsystems are enabling the embedded intelligence layer of the AI-enabled physical world at low cost and low energy by integrating sensing, edge computation, communication, timing and control. Companies like Pragmatic Semiconductor—headquartered in Cambridge, with manufacturing in County Durham—are putting the required manufacturing model into production, backed by National Wealth Fund-anchored investment alongside private capital[127] and shared infrastructure such as the Centre for Process Innovation's National Centre for Printable Electronics, which has played a direct role in scaling Pragmatic's manufacturing model from prototype to production.[128] For this frontier capability, value increasingly depends on control over the manufacturing, design and IP, and integration of microsystems that connect physical environments to data and decision-making, drawing on capabilities already present in the UK but dependent on continued investment and use, in line with other international actors like the USA increasingly governing strategic industrial capabilities through national-security controls.
4. **In clean energy**, the energy transition is driving investment into technologies critical to electrification[129]. Advances in domestically deployed electrification infrastructure—from EV charging networks[130] and smart grids[131] to industrial power conversion[132] and building energy systems[133]—are creating a sustained demand signal for the microsystems technology that complements semiconductors: microfluidics that manage heat, integrated sensing with power conversion and package multiple functions compactly. The UK's compound semiconductors base—anchored by the globally recognised South Wales CSconnected cluster generating £434 million in GVA and £466 million in exports in 2024,[134] alongside investments such as Vishay Intertechnology's £250 million investment into Newport Wafer Fab[135]—already produces the GaN and SiC devices, this infrastructure depends on, positioning microsystems as an opportunity that builds on existing domestic capability rather than requiring it to be created and tied to a demand that cannot be easily offshored. The window lies in capturing that value domestically, across all critical supply chains underpinning "an independent, secure, and resilient energy system for the UK".[136]

III

Rising to the moment

The UK microsystems sector is growing, and in places fast, but it faces scaling challenges. Adjacent fields—software, AI, quantum—that are more visible, more legible to investors, and more present in the public imagination, are competing for the same talent, capital, and infrastructure investment. The next phase of development for microsystems requires institutional support across four areas: the talent pipeline, the funding landscape, the fabrication infrastructure, and the coordination mechanisms that allow the ecosystem to function as more than the sum of its parts and, in doing so, contribute to a self-reinforcing national industrial base.

Talent: Building the pipeline for long-term growth

Microsystems draws on a wide range of disciplines—including materials science, physics, mechanical and electrical engineering, chemistry, biology, and computing—in which the UK has established pockets of research strength. While the breadth itself creates coordination and skills challenges, the pressures on the talent base extend beyond complexity alone: entry into the field is limited at multiple levels, a significant share of the workforce is nearing retirement, and the applied capabilities required to translate research into manufacturable products—from design for manufacture and systems engineering to hands-on fabrication—remain significantly underdeveloped relative to the UK's academic strengths.

> Microsystems, perhaps more than any other field, is inherently multidisciplinary. So if you have small, isolated pockets of activity, you do not necessarily have that full set of skills available.”
>
> **Ian Sturland**
> Fabrication expert, Folium Optics

Evidence from the UK Semiconductor Workforce Study,[137] commissioned by the Department for Science, Innovation and Technology in 2025, quantifies the growing strain on the technical workforce, including annual shortfalls projected to increase year-on-year to over 3,400 highly skilled roles by 2030 and a looming retirement wave of nearly 40% of the workforce within 15 years. Microsystems, spanning a broader and more specialised skills base, faces constraints that are similar in scale and, in specialised roles, more acute.

FIGURE 12

Ecosystem perspectives highlighting a cascading talent pipeline challenge, from low awareness and weak attraction to skills shortages and an ageing workforce.

Perspectives from the ecosystem

School-level invisibility	University underfunding	No Doctoral Focal Awards	Technician Shortage	Ageing workforce
If we are serious about industrialising [microsystems] technologies, they need to be sectors that people at school recognise as aspirational. Students need to know the opportunity, and parents too.	There are many factors affecting the UK's engineering talent pool. As universities compete to attract students, some have closed engineering departments due to high operating costs relative to other courses, with a detrimental effect on the talent pipeline.	Innovation funding is not lined up with the investment in centres for doctoral training, which fund the PhDs. The programs don't join the dots, with the risk of creating pools of people or innovation capabilities that don't match.	We call them unicorns. If you went out there for a packaging engineer with 20 years of experience working in a factory, you wouldn't find any out there. They don't exist, they're gone. In this ecosystem, you've got to make them yourself.	There is no meaningful talent pipeline into the sector. Young people simply aren't being drawn in, just as skills data suggest a looming demographic cliff.
Brendan Casey CEO, Kelvin Nanotechnology Ltd	**Andy Sellars** Advisor, Silicon Catalyst - EPSRC - OECD	**John Goodenough** University of Sheffield	**John Boston** Managing Director, Custom Interconnect Ltd	**John Goodenough** University of Sheffield

> In microsystems, we no longer have in the UK applicants with a knowledge of product engineering concepts—design for manufacture, systems engineering, the ability to translate from idea to device."
>
> **Anne Vanhoestenberghe**
> Director, MAISI, and professor of Active Implantable Medical Devices, King's College London

A microsystems view of the talent pipeline highlights four priority areas:

Awareness: Building visibility of microsystems careers early on.

Awareness and knowledge of microsystems at the school level remains sparse—"most students are not even taught what a transistor is," according to Steven Riches, IMAPS-UK Secretariat. That means neither career guidance nor individual aspiration can orient toward the field. Initiatives like the UKESF's 2025–2030 strategy for electronics[138] exemplify how awareness is being built in specialised technical domains, combining career visibility with school-level engagement and industry links. Frontier technologies such as quantum provide a long-running perspective: under the 2023 National Quantum Strategy,[139] early-stage awareness among school-aged children has been defined as a top priority and delivered at scale, with delivery bodies such as the National Quantum Computing Centre reaching over 1,500 students and teachers and more than 3,000 members of the public—setting a benchmark for the level of coordinated visibility and signalling microsystems should aim to achieve in order to broaden awareness and strengthen the upstream pipeline. The same approach could be applied to the microsystems sector and its array of niche but consequential fields.

Inflow: Increasing alignment between degrees, industry, and resource access.

While the UK produces a substantial number of STEM graduates each year[140] (around 300,000 in the 2024/25 academic year, based on HESA subject groupings), relatively few enter hardware-relevant fields, with talent instead concentrating in software, AI, and adjacent domains. As a proxy, entrance into semiconductor roles is estimated at approximately 870 graduates per year,[141] including both UK and international students graduating from UK universities, well below projected demand. Capacity in these disciplines is also shaped by how they are funded and delivered: lab-intensive courses require cleanroom access and specialist equipment, making them significantly more expensive to run than classroom-based subjects. Within a fee-based funding model, this constrains provision and contributes to course closures. Even where students enter these pathways, degree structures do not consistently translate into industry-ready capability: three-year programmes compress the balance between foundational theory and applied training, compared to longer European programmes, limiting graduates' exposure to core engineering fundamentals and their ability to transition into roles requiring prototyping, fabrication, and integration. Coordinated design of curricula, infrastructure access, and industry engagement—as demonstrated by models such as the Warwick Manufacturing Group[142] and the SPECIFIC Innovation Centre[143]—could strengthen talent flows into microsystems, where greater alignment across these elements could unlock growth at scale.

Capability: Building full-stack microsystems capability across design, modelling, and applied roles.

While the UK has strong research capabilities and world-class expertise in specific areas of fabrication and packaging, constraints are visible at both ends of the microsystems capability stack: upstream design, modelling, and verification, and downstream applied fabrication, packaging, and production skills. Upstream, the ability to simulate microsystems behaviour and verify AI-assisted designs is increasingly critical for next-generation sensors, energy harvesters, and computing devices, as highlighted at the UK Microsystems Network event in York in March 2025[144] and endorsed by STMicroelectronics. At the downstream end, scale-up is constrained by capacity shortfalls in applied, production-facing roles, where the UK's capability in packaging and fabrication—such as wire bonding, wafer dicing, encapsulation, and precision assembly—remains weak, particularly at technician and mid-level engineering tiers required for scale-up.

Evidence from across the ecosystem points to persistent hiring difficulty in these roles: technician positions, especially ones needing semiconductor training, are described as “nigh on impossible” to fill—in Brendan Casey’s words at Kelvin Nanotechnology—, with experienced packaging engineers characterised as “unicorns” by John Boston at Custom Interconnect Ltd, reflecting a labour market in which relevant experience is both scarce and unevenly distributed. This is consistent with the UK semiconductor workforce, which found 90% of firms facing shortages in key technical skills,[145] with at most 0.4% of the workforce entering via apprenticeships. Microsystems firms are responding by recruiting from adjacent fields—such as precision laboratory science, biomedical manufacturing, and aerospace engineering—and by training internally. While resource-intensive, this approach demonstrates both the transferability of relevant skills and the sector’s readiness to build capability, highlighting the opportunity for more coordinated pathways.

Retention: Deepening ecosystem capacity to preserve, renew, and deploy skills over time.

A significant share of the current microsystems workforce is approaching retirement, with experience concentrated in later-career cohorts—across the ecosystem, R&D teams are described as “over 40 on average”, and professional communities characterised by Steven Riches at IMAPS-UK as skewing “towards the end of their working life”. This creates a near-term risk of capability loss, particularly in tacit, experience-based skills that are difficult to replace. Established clusters within the UK—particularly in Cambridge, Oxford, and London—demonstrate the benefits of greater ecosystem depth, where networks of firms, research institutions, and adjacent opportunities allow individuals to progress without leaving the field. Elsewhere, roles are more isolated, with individuals required to bridge specialist skills gaps in isolation and fewer opportunities for progression or lateral movement. Strengthening connectivity between clusters, expanding regional ecosystems, and enabling greater mobility of talent across firms and institutions would support the retention, renewal, and circulation of skills—allowing the workforce to be sustained and developed at the scale required for continued growth.

The central task for microsystems is to scale the talent pipeline beyond a model in which individual firms absorb costs that, in ecosystems with stronger shared identity and broader training infrastructure, are shared across institutions. Workforce projections across adjacent technical fields point to growing shortfalls and an ageing skills base, reinforcing the urgency of establishing coordinated pathways in the UK to develop and sustain talent that would allow the ecosystem to build capacity at scale and secure a greater share of the high-value manufacturing and integration activity associated with these capabilities.

CASE STUDY

The Custom Interconnect Ltd model: Manufacturing a workforce from scratch

In 2019, Custom Interconnect Ltd—the UK's largest outsourced semiconductor assembly and test (OSAT) facility,[146] based in Andover, Hampshire—faced a staffing constraint widely experienced across the UK's semiconductor-to-system value chain: the high-skilled technicians it needed did not exist in the UK labour market. "If you went out there for a packaging engineer with 20 years of experience working in a factory doing packaging, you wouldn't find any out there," explains John Boston, its managing director. The response was to treat workforce development as a core business function rather than a recurring recruitment problem—"in this ecosystem, you've got to make them yourself," Boston argues.

The company launched a structured graduate programme, anchored in part by government-funded project work through the Advanced Propulsion Centre[147] and the Driving the Electric Revolution[148] initiative, which provided the commercial scale to justify hiring graduates. Around twenty graduates joined the first cohort, and approximately half remain, each now carrying five to six years of hands-on packaging experience—placing them among the most practically experienced packaging engineers in the country. An apprenticeship programme has since been added at technician level, and the company has begun sponsoring PhD students, completing a pipeline from entry level through to postgraduate research built largely from first principles.

Boston is unambiguous about the time horizon: "It's a long-term plan with a long-term strategy, and a long-term goal." New entrants require several years to reach full productivity, and the investment only holds if the company retains the people it trains—a characteristic typical of deep tech sectors. With government-backed project funding acting as a catalyst, CIL has unlocked this model and is now packaging for defence primes, major automotive manufacturers and AI companies, trebling its turnover since 2021. A workforce the sector needs collectively was built by one company with the right external support at the right moment—demonstrating the level of growth achievable when sustained demand and workforce investment are aligned, and the need for coordinated mechanisms to scale this model beyond individual firms.

Funding: Unlocking the journey from discovery to scale

Underpinned by a well-capitalised public R&D base, recently reinforced by a £55 billion funding commitment,[149] UK deep tech boasts a strong discovery ecosystem that consistently produces high-quality research and early-stage ventures. This lets firms build validated technologies and secure early investment, but the path becomes less defined as they move towards commercial scale.

For microsystems, the barriers to scaling include capital intensity, long development cycles, and reliance on manufacturing infrastructure. Ensuring that firms can realise their commercial potential requires continued, hardware-aligned pathways that enable them to scale, manufacture, and remain anchored in the UK, as analysed in the stage-specific view shown here.

Discovery: Realising microsystems' share of the UK's strong discovery foundations.

The UK's funding architecture performs most consistently at the discovery stage, where public and private mechanisms are broadly aligned with the needs of early research and venture creation. Curiosity-driven funding—primarily delivered through bodies such as the Engineering and Physical Sciences Research Council (EPSRC),[150] which support investigator-led academic research—underpins a diverse pipeline of foundational research across microsystems-enabled disciplines. Innovate UK programmes provide complementary support[151] at the proof-of-concept and early validation stages, while the broader UK tech venture ecosystem remains active at seed and early Series A stages.[152] Yet funding specifically for microsystems has been increasingly declining across stages, reflecting a structural visibility difficulty for a multi-disciplinary and enabling field like microsystems that cuts across EPSRC's broad engineering and physical sciences remit, where funding flows towards the applications that microsystems enables while the underlying capabilities remains under-appreciated. A clearer recognition of microsystems as a named strategic capability would allow the UK to build on an already strong discovery base, connect research now dispersed across application domains, and strengthen the pipeline of technologies that future sensors, energy systems, medical devices, computing platforms, and industrial automation will depend on.

Applied and growth stages: Extending continuity to support commercial readiness.

As companies move beyond early validation, the central opportunity is to build greater continuity in funding pathways. Innovate UK has expanded its deep tech portfolio in recent years—the crown jewel being semiconductors,[153] which has seen dedicated programmes and Innovation and Knowledge Centres introduced since 2022. These initiatives can inform and complement the microsystems ecosystem, particularly Silicon Catalyst[154]—the world's only incubator focused on semiconductor solutions—delivers UK startups with in-kind access to design tools, fabrication services, EDA software, and a network of over 400 investors through a structured 24-month programme with ChipStart UK, under a government mandate from the National Semiconductor Strategy since 2023[155]—with the first cohort of eleven companies raising £10 million in private investment in nine months.[156] Alongside these public-backed initiatives, newer entrants such as Cloudberry[157]—Europe's first dedicated semiconductor venture fund—are beginning to target pre-seed and seed investment in frontier technology, signalling early private sector appetite for specialist hardware funding.

Because this growth-stage activity is framed around semiconductors and other established frontier technologies broadly, support for microsystems remains limited and distributed across a wide base, often at a scale that does not match the capital intensity and time horizons of hardware development.

> The investment gap, between the UK and US, is partly due to the level of funds – which are much higher in the US, but there's also a lack of deep tech experience, as investors have looked for lower risk options such as software apps. However, this is starting to change with new investment funds focussing on deep tech."

Andy Sellars
Semiconductor industry advisor and chair of the semiconductor expert working group, UKTIN

Multiple experts interviewed in this report warned of "zombie companies" surviving on recurring grant cycles rather than building towards commercial independence—receiving enough support to continue, but not enough to scale. The growing role of innovation contracts[158]—where the government acts as a customer through deliverable-based agreements—offers promise, as they are aligned with hardware development cycles and clearer milestone delivery. As the broader public funding landscape is itself in transition, including recent restructuring within the national funding agency UK Research and Innovation (UKRI)[159] and the introduction of new initiatives such as the Innovation Accelerator programme[160] supporting regional innovation clusters, ensuring continuity and clarity will be important to build confidence and momentum in areas where the UK has established strengths.

Scale stage: Building access to later-stage capital and growth pathways.

Research from the Royal Academy of Engineering State of UK Deep Tech 2025[161] finds that, while UK deep tech startups raise an average of £3.8 billion annually in venture investment, domestic participation in late-stage funding has reached its lowest level at just 9%, with US investors filling most of the gap at Series B and beyond. Conversion rates for UK startups to larger funding rounds above $15 million (equivalent to £11+ million) have also fallen to roughly half the level seen among their US peers—4.1% against 8.3%—within an estimated £3-8.5 billion (equivalent to $4-11 billion) investment necessary to close this annual domestic funding gap. For microsystems companies, whose development cycles run in years rather than months, a delayed or missed growth-stage round can strand a product between validation and commercial viability at the point where sustained investment would be most productive.

Alongside capital availability, investor expectations and market structures pressure company trajectories. Deep tech businesses, particularly in microsystems, operate on longer development cycles and require sustained investment[162] through to manufacturing scale. Most investors remain oriented towards software, where products pivot rapidly and capital is redeployed quickly—a dynamic consistently reflected in industry interviews conducted for this report, and one that can keep hardware companies at sub-optimal scale.

Public markets reinforce this investor orientation: UK stock exchanges have historically been less conducive to deep tech hardware firms, whose commercial milestones are harder to communicate to generalist investors. This contributes to a recurring pattern in which companies reach a certain maturity and list overseas, remain private,[163] or seek acquirers, often by overseas buyers. This pattern is evident in sectors such as described in Cambridge's industrial inkjet cluster' case study—world-leading, UK-manufactured and globally exported—which has seen successive companies acquired by international buyers over several decades. While such outcomes can represent successful exits, they limit the amount of economic value retained within the UK,[164] including through corporation tax, high-value employment, and reinvestment into subsequent ventures.

Shifting funding models and market norms towards a hardware-aware perspective matters more in the current global context, where capital-intensive, manufacturing-linked industries are regaining strategic importance,[165] and where physical production capacity is increasingly tied to economic resilience and geopolitical advantage.

Taken together: These dynamics point to an opportunity to strengthen *continuity of scale pathways* within the national ecosystem: aligning capital, expertise, and market structures so that companies can grow through successive stages without structural pressure towards early exit, foreign acquisition, or the relocation of scale activities overseas—a cultural shift as much as a capital one. Recent initiatives—notably ChipStart UK's in-kind incubation support[166] led by Silicon Catalyst, which has demonstrated strong early results but remains focused on semiconductors broadly rather than microsystems specifically, alongside broader measures such as the British Business Bank's expanded remit[167] and Innovate UK's Growth Catalyst support[168] and new commercialisation approach[169] to better prepare deep tech companies for investment and crowd in private capital—are positive steps, with the priority now to extend their reach and scale to better serve the capital intensity and longer deployment cycle of UK microsystems companies.

CASE STUDY

CN Bio: Scaling innovation, exporting manufacturing

A printer-sized organ-on-a-chip system that can sustain living human tissue—perfused, functional, and responsive to drugs—captures both the promise of microsystems and a growing challenge in the UK: the ability to invent globally competitive technologies, but not always to scale and manufacture them domestically.

Founded in 2010 as a spinout from the University of Oxford, CN Bio's path was not linear:[170] the original technology proved unworkable, and the team in-licensed a more promising platform from MIT before finding its commercial footing.

At the core of its current technology is a microfluidic perfusion system that mimics blood flow, sustaining three-dimensional human tissue models of the liver, lung, and intestine while enabling controlled, data-rich experiments—a necessary capability as drug development shifts towards human-specific therapies that animal testing struggles to predict.[171] As Tomasz Kostrzewski, its chief scientific officer, puts it: "We can build all the technology we want… but in the end what really matters is where this molecule is better, and do I have enough confidence in the [generated] data to believe a drug is actually going to succeed?"

Early development was supported by Innovate UK funding. A decision in 2018 to shift from a service model to shipping instruments that customers could operate independently then enabled the company to scale beyond its own laboratory capacity, with recent growth reinforced by regulatory momentum[172] and increasing industry demand for human-relevant testing models that Kostrzewski describes as making him "pretty bullish about where things are going over the next few years." More than 150 systems are now deployed globally, with large pharmaceutical companies and academic institutions as primary users, and the United States accounting for roughly 60% of demand.

But as it scales, the company is discovering "a real gap, particularly in government support." That gap defines how and where manufacturing is scaled: while final assembly remains in Cambridge, cost considerations and proximity to its main customer base increasingly point towards relocation. "There's very little incentive to keep it in the UK at this point," Kostrzewski observes, until policy discussions around strengthening domestic manufacturing come to fruition. In this context, Kostrzewski points to a broader disconnect: "life sciences is a real key part of the UK's economic strategy… but it never quite feels like it gets the prominence it deserves, given how much of a driver of growth it can be." The dynamic extends beyond CN Bio: "you see it quite generally with UK businesses… they end up getting sold, rather than being built into a multinational."

The consequence is a recurring pattern in which the UK generates microsystems innovations but captures only a fraction of their long-term value. CN Bio's trajectory—a globally competitive platform in strong demand, built on decades of UK microfluidics research—is evidence of what anchoring that value more deliberately could unlock.

Infrastructure: Sharing capability in a distributed field

Unlike some nations offering centralised "mega-fabs," the UK operates a versatile network of specialised fabrication facilities that span the full stack, from atomic-layer materials to pilot-scale manufacturing—enabling the high-mix, low-volume model central to the UK's strategy in next-generation microsystems-enabled applications.

A useful framework, drawn from practitioners across the sector, describes three models through which the ecosystem accesses these fabrication capabilities:

1. **In-house facilities** are owned and operated by large, vertically integrated firms that can sustain dedicated capability, giving full control over process and IP. The UK hosts more than 25 such sites just for semiconductors[173]—including Plessey, Semefab, and Teledyne e2v—which anchor production but remain closed to the wider ecosystem. Of these, only a small number have dedicated industrial MEMS or microsystems fabrication capability, and only Semefab offers foundry access to external customers,[174] making access to such sites a constraint for the wider ecosystem.

- Foundry services provide shared access to advanced fabrication through standardised process flows, often via multi-project wafer (MPW) runs—where multiple users share a wafer and split cost—used by startups, SMEs, large firms, and researchers to access high-end capability without the capital cost of ownership. Two major open-access hubs anchor this model of "on-ramp innovation" across microsystems-related capabilities in the UK:
- Zepler Institute,[175] Southampton: Serves photonic integrated circuit (PIC) customers across more than twenty countries through the Cornerstone foundry, and is the proposed host of the national platform MICROCRAFT which could extend the same open-access fabrication logic to MEMS and NEMS technology development with dedicated funding.
- Centre for Process Innovation (CPI),[176] Teesside: Provides the critical bridge to commercial volume across printed electronics, sensors, and medical devices—supporting companies like Pragmatic Semiconductor from early development to industrialisation.

Alongside these device-fabrication and scale-up centres, adjacent semiconductor facilities provide further evidence of how dedicated national infrastructure can support specialised technology fields:

- Compound Semiconductor Cluster (CSconnected),[177] South Wales: Represents the UK's primary industrial scale-up engine, offering high-volume foundry services for the advanced materials (GaN, InP) that power 5G, electric vehicles, and sensing.
- National Epitaxy Facility,[178] Sheffield/Cambridge/UCL: Supports the material foundation, growing the bespoke semiconductor wafers that serve as the "physical layer" for the entire UK research base.

2. **Open-access research facilities** offer specialist fabrication access on a project-specific basis, without the standardised process flows of a foundry model. Operating at a level of capability and scale that distinguishes them from typical academic cleanrooms, they serve researchers and companies requiring advanced, bespoke device work:

- James Watt Nanofabrication Centre (JWNC),[179] Glasgow: Offers project-specific access to cleanrooms ranking among Europe's most advanced, with particular strength in specialist device work and high-resolution electron-beam lithography.
- Scottish Microelectronics Centre (SMC)[180], Edinburgh: Provides specialist fabrication and packaging capability in a similarly open-access model, serving both research and industrial users.

3. **Distributed academic facilities**, which characterise the UK's predominant reality according to experts, offer project-specific access to specialised tools and expertise through dozens of cleanrooms, from UCL[181] and Imperial[182] to Leeds[183] and Bristol.[184] Without the constraints of a pilot line or foundry model, these facilities are precisely the right environment for fundamental research, where cutting-edge device concepts and novel process innovations are developed and validated. While this model has core strengths in flexibility and breadth, it cannot offer reproducibility at scale: reliable device fabrication depends on high wafer throughput[185] (consistent production volume) and tightly maintained equipment, conditions that facilities operating under constrained budgets and variable demand struggle to sustain consistently, and that fall outside the core remit of research institutes.

The UK now has the opportunity to create a "national virtual foundry"—linking its distributed assets into a single, accessible system spanning materials, fabrication, and early manufacturing that can enable a continuous path from research to production. Delivering this requires four infrastructure advancements:

1. **Capability visibility to make the system discoverable and usable.** Effective access requires visibility of available capabilities. Today, the UK's fabrication capabilities are distributed across institutions with well-established standards within individual facilities[186] but limited consistency in how they are described, accessed, or engaged. For new entrants in particular, identifying the right facility, process, and entry point remains a fragmented and time-intensive task. A national capability catalogue—covering tools, processes, design rules, and access routes—would provide a clear interface to the system. Combined with standardised documentation (e.g., process design kits)[187] and a small number of defined entry points, this would make the infrastructure legible and usable, reducing time to access and enabling faster iteration from design to prototype.

2. **Open-access fabrication to maximise output from existing capability.** The multi-project wafer (MPW) sharing model has proven its value in photonics through Cornerstone,[188] demonstrating how shared infrastructure expands both access and capability over time. This approach could be extended into MEMS and NEMS via MICROCRAFT, a proposed national platform currently seeking dedicated funding designed to advance low-TRL university research towards manufacturable devices through open-access fabrication. The case for it is direct: full MPW access—the key mechanism that makes advanced fabrication economically accessible to early-stage companies—remains less mature for MEMS,[189] where process heterogeneity and limited standardisation make shared runs less routine, and is not yet widely established across other domains. Without it, companies must depend on overseas foundries, ceding control over timelines, process access, and product evolution outside the domestic ecosystem. Expanding and sustaining open-access fabrication is essential to ensure that this infrastructure can become available broadly, not just by those with in-house capability, across the full microsystems value chain.

3. **Equipment maintenance to ensure stable, reproducible operation.** The performance of fabrication infrastructure degrades gradually when maintenance is deferred: tools drift out of calibration, process variability increases, and results become harder to reproduce without a clear point of failure. Industrial fabs mitigate this through OEM (Original Equipment Manufacturer) service contracts[190] providing structured maintenance, specialist support, and rapid response to minimise downtime; university facilities, operating under tighter budgets, often face delays of weeks for repairs. A near-term, low-cost response already identified within the community is collective purchasing and shared service contracts—standardising on common equipment types across universities enables bulk spare-parts procurement and shared maintenance costs. The investment required is modest, the ecosystem's willingness to participate is real, and the foundations are in place to begin building coordinated procurement and shared maintenance frameworks

4. **Advanced packaging to enable integration into complete, deployable systems.** Packaging—the integration of chips, sensors, and electronic functions into a single system—accounts for a large share of both cost and value in microsystems. The UK has strong capability in this area, with firms such as Custom Interconnect Ltd, RAM Innovations and Gooch & Housego, alongside a wider ecosystem of specialist providers serving defence, photonics, and high-frequency applications. The constraint lies at the prototyping and pre-production stage: open-access packaging infrastructure remains limited in the UK. The recently established CHIMES IKC strengthens the research and demand-generation base for heterogeneous integration, defining the technical agenda and building the IP base that industry needs to adopt advanced packaging, but without shared physical infrastructure to act on that agenda. As a result, companies developing new systems must either build packaging capability internally or rely on overseas providers. With heterogeneous integration becoming a key driver of value in advanced packaging[191] —and increasingly underpinning microsystems integration—establishing a shared packaging layer is critical to turning device-level innovation into deployable products.

The infrastructure trajectory is positive: the UK combines strong existing capability with clear institutional will across universities and industry. What is now required is the connective infrastructure to coordinate, sustain, and scale what already exists—establishing the institutional layer that allows these assets to function as a system.

> I've learned that fabricating a chip in Arizona costs around two and a half times as much as fabricating the same chip in Taiwan, as Taiwan has an ecosystem that keeps the cost down. This shows how important the ecosystem is."
>
> **Andy Sellars**
> Semiconductor industry advisor and chair of the semiconductor expert working group, UKTIN

A relatively modest investment—measured in the tens of millions, not billions—in the "glue" of maintenance, visibility, MPW access, and packaging would be sufficient to connect these assets into a coherent system. With this in place, the UK's distributed fabrication base can make a national virtual foundry a reality, enabling many microsystems applications that are currently out of reach.

CASE STUDY

Semefab: The UK's independent MEMS manufacturing backbone

A pair of wafer fabs in Glenrothes sustaining over 500 million chips[192] a year speaks to a structurally rare capability for microsystems in the UK: the ability to manufacture at scale without relying on multinational ownership or state-backed infrastructure.

Founded in 1986 and based in Glenrothes, Scotland, Semefab has built four decades of experience[193] across microelectromechanical systems (MEMS) sensors, analogue and mixed-signal integrated circuits (ICs), discrete semiconductors, and compound devices. More than 70% of its production is exported to customers in Europe, the United States, and Asia, embedding the company within global supply chains despite its relatively small scale. Crucially, Semefab operates as a fully independent foundry, serving external customers rather than internal product lines—something distinctively unique, as fabrication capability typically consolidates into large, vertically integrated deep-tech companies.

For the UK, this capability supports a critical stage of the innovation pipeline: translating device designs into manufacturable, scalable products. Semefab provides a domestic route from prototyping to volume production, reducing reliance on overseas foundries when designs become commercially sensitive and harder to transfer. Its accumulated process library—built over decades of continuous operation—also represents a form of industrial memory that would be costly and time-consuming to rebuild if lost.

Sustaining and expanding that position, however, depends on conditions that are not guaranteed: maintaining diverse process technologies, investing in equipment, and keeping volumes high enough for stable, repeatable production all require consistent demand and long-term visibility of returns. In a sector increasingly shaped by scale and public investment elsewhere, Semefab highlights where targeted support, sustained demand, or strategic alignment could reinforce an existing domestic capability—strengthening the UK's position in microsystems manufacturing without needing to build it from first principles.

Coordination: From activity to ecosystem alignment

Microsystems is, by its nature, difficult to recognise as a distinct field. Its capabilities are embedded within the technologies it enables—distributed across materials, devices, and subsystems—such that even researchers, engineers, and companies within the community typically describe their activity in terms of application or material rather than the underlying microsystems foundation. At the same time, the effectiveness of a microsystems ecosystem is defined by how its capabilities connect across institutions, stages of development, and over time.

> You can sell the concept of a battery, but selling the concept of a microsystem when it's a small component that goes into something else, that's much more difficult and getting a coherent strategy for that is probably also very difficult."
>
> **Steven Riches**
> IMAPS-UK Secretariat

The same integration-intensive qualities that make microsystems widely enabling across sectors also make them inherently more difficult to coordinate and advocate for. IMAPS-UK,[194] the UK chapter of the world's largest microelectronics packaging society, already provides a coordination layer for frontier technologies through its annual MicroTech[195] conference, specialist workshops, and a member network connecting industry and academia—a community that the UK Microsystems Network has already drawn on to raise awareness of its own activities. Unlike Canada's CMC Microsystems,[196] which performs a similar coordination and ecosystem-building function, IMAPS-UK and its network operate with no comparable public mandate, core funding, or open-access technology platform.

Building on this existing coordination capacity, the opportunity lies in strengthening three interfaces—industry–academia collaboration, research commercialisation, and system visibility—so that the ecosystem's constituent capabilities can be aligned, scaled and represented within a coherent national strategy.

1. **Strengthening continuity in industry–academia collaboration.**

Collaboration between the UK microsystems industry and academia is active and, in many cases, productive with companies such as Xaar, Oxford Instruments, and General Electric maintaining ongoing partnerships with leading universities. Much of this activity is initiated through personal and project-level connections, which have proven effective in aligning specific technical challenges with relevant expertise, even in a field such as microsystems where expertise is distributed across domains. The continuity of these collaborations, however, remains closely tied to the individuals and projects that initiate them. When those relationships end—through retirement, institutional change, or shifting research priorities—the collaboration tends to dissolve with them, with limited mechanisms to carry it beyond the projects and people that initiate it, against a backdrop of increasingly uneven and declining university–industry collaboration.[197]

> Collaboration in microsystems currently happens very much on a case-by-case basis—an individual academic will tie up with an individual company, rather than through a more coordinated national approach."
>
> **Steven Riches**
> IMAPS-UK Secretariat

Where collaboration mechanisms translate individual relationships into structured programmes, their impact becomes more durable and repeatable. Several models already illustrate this transition:

- Knowledge Transfer Partnerships (KTPs)[198] embed collaboration within defined commercial challenges through one- to three-year placements, sustaining knowledge exchange and widely regarded across microsystems companies interviewed as well calibrated between academic and industrial objectives.
- Sponsored Master of Science (MSc) projects—where companies fund and co-supervise student work over three to six months—combine short-term problem solving with a clear recruitment pathway, enabling early-stage alignment between emerging talent and industry needs.
- Innovation and Knowledge Centres (IKCs)[199] bring universities and companies together around defined capability areas, creating focal points for collaboration in specific technology domains.
- Doctoral Focal Awards[200] (formerly Centres for Doctoral Training, CDTs) develop talent through cohort-based PhD programmes that integrate academic training with industrial engagement, supporting the development of deep technical capability over time—though by nature they benefit host institutions directly, a limitation in a field as broad as microsystems where a single award risks serving one research cluster while leaving adjacent communities outside its scope.

In microsystems, these models are not yet configured at the level of the field: KTPs and MSc projects are widely used and often successful, as showcased by the “outstanding” grade given to a KTP between Xaar and UCL,[201] but at the scale of individual projects; IKCs and Doctoral Focal Awards operate primarily in adjacent domains such as photonics and compound semiconductors, but none exists at the level of integrated microsystems with only CHIMES[202] representing a meaningful signal by providing an IKC specifically focused on heterogeneous integration and advanced packaging.

This points to how collaboration is configured across the field: translational centres, infrastructure, training programmes, and industry engagement are all present, but not consistently aligned to support continuity and reuse of capability. In fields where Doctoral Focal Awards play a central coordinating role, as seen in the SENSE programme[203] for sensor and measurement systems, these components are connected through a shared focal point, linking training, research, and industry engagement that supports a reinforcing relationship between talent development and industry engagement.

Confirming a cross-institutional microsystems Doctoral Focal Award—aligned with existing translational centres and IKC-type capability hubs, and interfacing with Catapults[204] and networks—could extend this model across the field, acting as one mechanism to strengthen continuity of collaboration within a more cohesive research and industrial community, with multiplier effects in a field where capability is defined by integration.

> How many mechanisms do we have? Do they talk to each other? Networks, catapults, IKCs, hubs—when you scratch the surface, everybody is trying to do similar things, and there’s clearly more scope for coordination.”
>
> **John Goodenough**
> Professor of microelectronic systems, University of Sheffield

> Ten to fifteen years ago, if we wanted to develop something, we'd develop it ourselves and keep it very secret. Those days are past: we cannot do everything ourselves. We want to cooperate, but the connections simply aren't there."
>
> **Angus Condie**
> Director of technology, Xaar

2. **Aligning commercialisation frameworks with engineering-led scaling.**

   Commercialisation frameworks shape how research is translated into ventures, and how risk, capital, and ownership are structured along that path. In microsystems, their effectiveness depends on how well they reflect the characteristics of engineering-led, integration-intensive innovation.

   The UK's commercialisation environment has evolved in recent years, with changes following the 2023 independent review of university spinouts[205] leading to lower average university equity stakes[206] and broader adoption of founder-friendly practices, primarily addressing how value is distributed at the point of company formation. This guidance, developed largely in the context of software and life sciences spinouts, also shapes how universities and investors evaluate opportunities, define milestones, and structure agreements.

   For microsystems—where IP is embedded in design, processes and materials, proof-of-concept requires fabrication rather than code, and the distance from laboratory to manufacturable product is measured in years and capital—progress is less linear and less easily captured through discrete technical or commercial milestones. Where frameworks are less closely aligned with these dynamics, additional interpretation and adaptation are required at the institutional level, shaping how universities approach IP, how investors assess risk, and how ventures progress.

   Extending existing best-practice guidance to better reflect engineering-led and integration-intensive fields such as microsystems would provide a more consistent pathway for venture development, counteracting the persistent friction around IP ownership and timelines in engineering-led spinouts[207] and supporting more effective translation from research to scale.

3. **Improving visibility of microsystems capabilities.**

   A coordination dynamic specific to microsystems shapes how the ecosystem is perceived and connected: a substantial share of commercially significant activity—across areas such as advanced packaging, heterogeneous integration, and specialist assembly—takes place under non-disclosure agreements (NDAs). This reflects the strategic and high-value nature of the work, but limits the extent to which capabilities can be identified through conventional channels.

   In a field where value arises from the design, fabrication and integration of components capable of spanning multiple physical domains, capabilities are often distributed across organisations and supply chains, and are not always visible through end products or public-facing outputs. For firms, this constrains the ability to identify complementary expertise or potential collaborators. For policymakers, it limits how far decisions on infrastructure, funding, and skills can be grounded in a complete view of the system.

   Within these constraints, improving how the ecosystem represents itself becomes a coordination function in its own right. IMAPS-UK's network of events and workshops already performs this community-building role on the industry side, while the UK Microsystems Network coalesces microsystems activity predominantly across academia, creating an opportunity to bring practitioners together and build connections beyond formal channels through joint collaboration. Approaches such as capability mapping—systematically identifying and representing the distribution of technical capabilities across organisations and supply chains—can formalise and extend into system-level visibility without requiring disclosure of commercially sensitive information, as illustrated by tools such as the UK Innovation Clusters Map,[208] supporting more informed connections between firms, institutions, and policy.

CASE STUDY

Connecting the dots:
How microsystems UK capabilities can come together

A power packaging company in Wales and a photonics company in Scotland, working on technically complementary challenges, were brought together through an Innovate UK international mission—demonstrating how structured interaction can convert latent technical alignment into commercial value. This same brokerage problem is inherent to microsystems: complementary companies, facilities, and capabilities exist, but too often remain unlinked.

The technical alignment was straightforward: power packaging focuses on how electronic components are assembled, protected, and connected within a system, while photonics integrates optical components—such as lasers or waveguides—into functional devices. In this case, adapting the packaging approach to meet the size and integration requirements of the photonics system enabled the two technologies to be combined within a single application.

As Iain Mauchline, head of semiconductors at Innovate UK, described, the connection only emerged once both companies were in the same setting. "By simply adapting the power packaging techniques, it can be made suitable for photonics applications." The adjustments and adaptations can be relatively straightforward, but the physical interaction between the power and photonics companies had not previously been made. The result gave both companies access to a different market, with the combined solution enabling a new application space neither had previously addressed. Experiences of this kind are a recurring feature of international missions. As Mauchline noted, "one of the things that comes out is the fact that companies that are actually in the next town don't know each other," and that "bringing together different aspects in one room can make a real difference". Compound semiconductors and power electronics have benefited from exactly this kind of structured ecosystem building.

For microsystems, no equivalent programme exists: connections like this are even less likely to emerge, and the opportunity to unlock the same value remains largely untapped. Giving the field a named coordination surface creates the condition for similar connections to form; when they do, the value is there to be found.

IV

Making success systematic

The UK's microsystems ecosystem already shows many of the qualities associated with global leadership, across both technical capability and real-world use. Pragmatic Semiconductor grew from a two-person funding team with access to Centre for Process Innovation (CPI) facilities to raise a record size semiconductor venture round for Europe[209] at the time. Custom Interconnect Ltd tripled in size over five years, serving defence primes and AI hardware customers while building a workforce largely unavailable in the domestic labour market. CN Bio closed 2025 as its strongest commercial year, supplying human organ models to pharmaceutical customers in over 120 countries from a Cambridge base.

Where similar pockets of success have translated beyond isolated outcomes—both in the UK and internationally—a consistent pattern emerges, shaped by the interaction between technical capability and its surrounding conditions, and defined by three recurring features:

- A **bridging mechanism** between academia and industry with incentives and timelines aligned to both research and market, sitting between the two without being captured by either (e.g., imec's industry-aligned R&D model).[210]
- A **long-term commitment** that extends beyond political cycles and spending reviews, reflecting the pace at which deep technologies mature and deliver returns (e.g. Japan's long-horizon semiconductor strategy).[211]
- A **legible field identity** with a name, a community, and a shared economic story, clear enough that capital, talent, and policy can orient towards it (e.g. the Netherlands' integrated photonics strategy).[212]

Where all three are present, technical capability translates into sustained industrial advantage; where one is missing, strong capability underdelivers.

CASE STUDY

Pragmatic Semiconductor: Bridging to scale

A bridging environment that connects research to industrial production can determine whether microsystems technologies reach scale, enabling intelligence to be embedded into everyday objects and manufactured in the billions.

Founded in 2010 as a “spin-in” from IP acquired from Manchester University,[213] Pragmatic Semiconductor set out to manufacture integrated circuits on flexible plastic substrates (known as “FlexICs”)[214]—an idea that required sustained development within the Centre for Process Innovation (CPI)[215] to become a manufacturable technology. CPI’s role was not to de-risk the science as the underlying physics was already understood: these flexible semiconductor devices integrate thin-film transistors, interconnects, and communication functions into ultra-thin, low-cost circuits that can be embedded directly into physical objects such as packaging and medical products—extending sensing, connectivity, and computation into contexts where conventional silicon cannot operate.

What CPI provided was a **bridging mechanism**[216] that neither a university department nor a commercial investor could offer at that stage: access to industrial-grade fabrication infrastructure, operational support, and an environment in which an engineering team could iterate towards a manufacturable process. This phase—between scientific feasibility and investable scale—required repeated design–fabrication–test cycles to achieve yield, reliability, and cost suitable for production, without the capital burden of building a fabrication facility or the constraints of short-term funding cycles. That bridging mechanism was sustained through a **long-term commitment**, enabling development over years rather than projects and aligning with the time horizons required for integration-intensive microsystems. As the technology matured, it also contributed to a more **legible field**, defining a clear application domain for ultra-low-cost flexible semiconductors[217] powering the electronics embedded into everyday products across supply chains, healthcare, and retail.

This combination unlocked successive rounds of private and public investment,[218] with Pragmatic raising over £400 million by 2024, establishing a 300mm wafer fab in County Durham,[219] and scaling towards production at billions of devices per year. A company that began with two founders and shared infrastructure now employs over 300 people, with manufacturing anchored in the UK and global customers across multiple sectors.

Though primarily a semiconductor company which puts non-traditional materials on non-traditional substrates rather than a pure microsystems one, Pragmatic shows how a bridging mechanism from discovery to scale, sustained over time and combined with a legible field, can translate deep technical capability into both industrial capacity and a growing market—establishing a model for translating microsystems capability into industrial scale across the ecosystem.

Five interventions are recommended to establish all three conditions systematically across the UK microsystems field:

1. **Name microsystems in UK technology and industrial policy**
2. **Extend dedicated growth financing for deep tech companies**
3. **Invest in shared fabrication and advanced packaging infrastructure**
4. **Build a coherent talent pipeline from schools to mid-career**
5. **Systematise coordination across the microsystems ecosystem**

The sections that follow develop each intervention in turn, setting out its proposed design and the rationale for its inclusion, grounded in the evidence and analysis developed across Parts I to III.

1. Position microsystems as an enabling layer of UK technology and industrial strategy

Recognise microsystems across relevant Industrial Strategy sector plans and technology strategies—including defence, life sciences, digital and technologies, and advanced manufacturing—and establish it as a named strategic capability in the next iteration of the UK Industrial Strategy.

In the early 2010s, quantum technologies in the UK were characterised by academic excellence but limited industrial visibility.[220] Activity was distributed across physics subfields, funding flowed largely through research councils, and there was limited coordination between universities, industry, and government around shared economic objectives. Over the following decade, this position evolved into a national effort under the National Quantum Strategy,[221] and the UK is now widely recognised as one of the leading countries in quantum technologies.[222] Technical progress has contributed to this ascendancy, but so has the development of a more visible and coordinated ecosystem in which investors, policymakers, and companies can strive.

Even though a considerably older field with roots stretching back over four decades, microsystems in the UK today exhibits many of the characteristics that defined quantum technologies at an earlier phase. The UK has established strengths across several microsystems layers—including specialist fabrication, advanced packaging, and bespoke engineering for high-reliability applications—that underpin activity across technological sectors that feature prominently in current industrial priorities, supporting a substantial economic base of £2.1 billion in direct output and almost 9,000 direct jobs. At the same time, this activity is not consistently recognised as a single field: work that would fall within a microsystems definition is currently distributed across multiple sector categories—appearing variously within semiconductor, advanced manufacturing, and frontier technology programmes—each operating with its own terminology, metrics, and policy framing. The eFutures Network+,[223] EPSRC's national network for electronic systems, exemplifies this dynamic: its 2025 Semiconductor R&D landscape report[224] identifies heterogeneous integration and sensors as priority investment areas, reinforcing the strategic importance of capabilities that sit at the core of microsystems activity. Without a named strategic home of its own, the coordination, funding, and talent development that microsystems requires are absorbed into the programmes it enables rather than directed at the integration capability they all depend on.

Some international actors have been moving already towards an integrated view of microsystems: the United States has long maintained a dedicated Microsystems Technology Office within DARPA,[225] reflecting a long-standing understanding that microsystems warrants strategic attention as an integrated field within defence research, while the Canadian semiconductor strategy[226] has more recently taken a step towards industrial strategy, explicitly identifying compound semiconductors, MEMS, and advanced packaging as co-investment priorities—a recognition that these capabilities are stronger together than apart. No major economy has yet taken the further step of naming microsystems as a distinct priority within a national industrial strategy, creating a first-mover opportunity for the UK.

Bringing microsystems into the language of relevant sector plans and technology strategies, e.g., any forthcoming update to the National Semiconductor Strategy[227] where appropriate, and then including microsystems as a named priority within the next iteration of the UK Industrial Strategy[228] would complete the connective tissue between the UK's industrial commitments, giving the field the shared identity that capital, talent, and policy can orient around, and establishing the UK as the first major economy to recognise that frontier technology value is created not just in individual components but in how they are brought together as multi-technology products.

Read more: The identity and visibility challenge this recommendation addresses is developed in full in Part I: The industry inside everything. The economic case—including sector size, regional distribution, and productivity—is set out in Part II—The economic contribution of the UK microsystems base.

2. Extend dedicated growth financing for deep tech companies

Introduce a dedicated scale-up mechanism—through the British Business Bank or National Wealth Fund—for hardware and integration-intensive companies, structured around innovation contracts and aligned to the longer development cycles of physical technologies.

The UK's funding architecture is strong at the early stages of technology development: the Engineering and Physical Sciences Research Council (EPSRC)[229] sustains a strong research base, Innovate UK supports translation,[230] and venture capital remains active at seed and early Series A, creating a reliable pathway from discovery to initial validation. As companies scale up, capital intensity increases, development timelines extend, and the transition from validated technology to scaled production becomes more demanding, particularly for hardware and integration-intensive businesses. In the UK market, this often results in companies slowing their growth, seeking international capital, or scaling abroad.

Greater alignment between institutions dedicated to later-stage investment, such as the British Business Bank[231] and National Wealth Fund,[232] and the realities of hardware development—where milestones arrive later and require longer-term backing—would allow more companies to move from early success to sustained scale. Innovation contracts,[233] where the government acts as an early customer through deliverable-based agreements, provide a mechanism that maps onto these development cycles, combining commercial discipline with a clear demand signal, supporting the transition from prototype to production.

Extending demand-led mechanisms such as Contracts for Innovation to the longer timelines and capital intensity of hardware development, and aligning later-stage investment institutions, would help microsystems companies scale within the UK—a model that the Aerospace Technology Institute (ATI) Programme[234] has demonstrated in aerospace through a ten-year, £2.3 billion co-investment structured around TRL milestone progression, UK exploitation requirements, and multiyear horizons. Adapting this model for microsystems, with evaluation criteria that reflect integration-intensive development, would give the field the scale-up conditions it currently lacks, in line with the broader direction of recent changes to Innovate UK's model.[235]

Read more: The scale-up funding gap this recommendation addresses is explored in depth in Part III—Funding: Unlocking the journey from discovery to scale. The CN Bio case study in Part III illustrates how this gap plays out in practice for a growing microsystems company; the Cambridge inkjet cluster case study in Part I shows the longer-term consequences when growth-stage support is absent.

3. Invest in shared fabrication and advanced packaging infrastructure

Support the launch, and sustained operation of MICROCRAFT as the UK's open-access microsystems development platform, and extend this capability to shared advanced packaging at the prototyping and pre-production stage that complements the UK's emerging heterogeneous integration research agenda from CHIMES IKC.

The UK's distributed fabrication base is substantial in breadth: anchored by four major open-access facilities—the James Watt Nanofabrication Centre (JWNC)[236] in Glasgow and the Scottish Microelectronics Centre (SMC)[237] in Edinburgh offering specialist project-specific fabrication capability, and the Zepler Institute[238] in Southampton and the Centre for Process Innovation (CPI)[239] in Teesside providing foundry and scale-up services—and extending across dozens of academic cleanrooms and more than 25 in-house production systems, collectively covering much of the microsystems value chain. These facilities provide a strong foundation of capability, with an opportunity to increase their combined impact through greater coordination, visibility, and sustained operational support.

Open-access fabrication has already demonstrated its value within the UK ecosystem through the Cornerstone Photonics Innovation Centre for photonics,[240] which has enabled international access through shared wafer runs, lowering the cost of entry to advanced manufacturing. MICROCRAFT, a potential UK national platform for open-access MEMS and NEMS (micro- and nano-electromechanical systems) development in Southampton,[241] builds on this approach for a critical subset of microsystems, spanning the established MEMS capability the UK has lost ground in and the forward-looking NEMS territory underpinning quantum sensing, AI-edge computing, and next-generation defence applications. Combining digital design validation with physical fabrication, design enablement and hands-on skills training, MICROCRAFT translates university research from low Technology Readiness Level (TRL) into manufacturable devices at the higher-TRL development stages where commercial viability is realised. Completing and sustaining this platform would reduce prototyping cost and risk while anchoring more commercial value domestically, and establish the model for extending this shared-access model across a broader range of microsystems technologies over time.

> An advanced fabrication facility needs to be active year-round to deliver state-of-the-art results. You need places that are busy, doing a diversity of work, in order to sustain the diversity of skills around them."
>
> **Ian Sturland**
> Fabrication expert, Folium Optics

The next step in that journey is advanced packaging: integrating chips, sensors, and electronic functions into deployable products accounts for the majority of value and complexity in microsystems (up to 80%). CHIMES Innovation and Knowledge Centre (IKC)[242] provides the research and demand-generation anchor for this layer, defining the technical agenda for heterogeneous integration and building the reusable IP that the industry needs to adopt advanced packaging at scale. MICROCRAFT is its natural complement: by scaling devices to manufacturable, high-yield production, it creates the fabrication foundation that CHIMES-aligned packaging infrastructure can then integrate into complete, deployable systems.

MICROCRAFT, alongside extending shared access to advanced packaging developed in direct coordination with CHIMES, would create a more continuous pathway from device-level innovation to system-level deployment at a higher TRL, enabling more advanced microsystems technologies to be developed, integrated, and scaled within the UK.

Read more: The infrastructure landscape this recommendation addresses is set out in full in Part III —Infrastructure: Sharing capability in a distributed field. The Kelvin Nanotechnology Ltd case study in Part II illustrates what fabrication capability ahead of its surrounding ecosystem looks like in practice.

4. Build a coherent talent pipeline from schools to mid-career

Establish a coordinated microsystems talent pipeline from school to mid-career combining school-level awareness, funding aligned to lab-intensive degree provision, and employer-led apprenticeship pathways into fabrication, packaging, and integration roles.

> If we are serious about industrialising [microsystems] technologies, they need to be sectors that people at school recognise as aspirational. Students need to know the opportunity, and parents too—there are exciting technologies on your doorstep, and they can lead to a really fabulous career.”
>
> **Brendan Casey**
> CEO, Kelvin Nanotechnology Ltd

The UK's microsystems talent pipeline is shaped by a set of connected constraints across stages: awareness at the school level remains limited, reducing the number of students orienting towards the field; lab-intensive degree programmes face higher delivery costs within a uniform fee model; and employers report persistent shortages of technicians and production-facing engineers, with experience concentrated in a workforce approaching retirement.

Strengthening the pipeline requires coordination across all education stages, as exemplified by the National Quantum Strategy's delivery model,[243] which unifies awareness, higher education, and industry placement into a single system with defined pathways, delivery bodies, and sustained funding. The National Quantum Computing Centre has already reached over 1,500 school students and teachers, supported by a clear career narrative and visible employer demand.

At the school level, establishing comparable visibility for microsystems would provide a foundation for the rest of the pipeline. IMAPS-UK, as an existing industry coordination network, is the natural vehicle for this: as demonstrated through its primary school electronics outreach with the Centre for Power Electronics,[244] with appropriate resourcing, it could provide the early-stage awareness and career visibility currently missing, linking school-level engagement directly to education and workforce pathways.

At the degree level, the cost of delivering microsystems-relevant courses reflects the need for cleanroom access and specialist equipment. Aligning funding with these costs—as in clinical and veterinary training[245]—would support continued provision in areas of strong industry demand. At the technician and mid-career level, structured apprenticeship and employer-led training pathways provide a route to build applied skills in fabrication, packaging, and integration roles where demand is highest.

Establishing a coordinated pipeline across school, higher education, and technical training would create a more continuous pathway into microsystems roles, supporting a new generation of technicians and engineers as they build on an experienced but gradually transitioning workforce.

Read more: The four-level cascade this recommendation addresses—from school visibility through to workforce retention—is developed in full in Part III—Talent: Renewing the pipeline for long-term growth. The Custom Interconnect Ltd workforce case study in Part III demonstrates what employer-led development with public co-investment can produce at the technician and mid-career tier.

5. Systematise coordination across the microsystems ecosystem

Strengthen coordination across the microsystems ecosystem by creating systematic links between skills, research, and industry through shared capability mapping and a specialised cross-institutional Doctoral Focal Award investment.

The UK microsystems ecosystem contains the key components of a strong system: active industry–academic collaboration, multiple funding mechanisms, and established research and innovation infrastructure. Their impact depends on how consistently they are connected throughout the research-to-commercialisation pathway so that the capability developed in one part of the system can be applied and extended in others.

Industry–academic collaboration is well established, with ongoing partnerships between companies and universities across the microsystems value chain, typically structured through collaborative R&D programmes and formal IP frameworks. These collaborations are often effective but remain tied to individual relationships; extending them through structured mechanisms such as microsystems-specific Knowledge Transfer Partnerships (KTPs),[246] Innovation and Knowledge Centres (IKCs),[247] and Doctoral Focal Awards[248] would allow capabilities to develop in concert. Each mechanism would play a different role: KTPs support targeted knowledge exchange, IKCs provide a platform for translational research, and Doctoral Focal Awards build deep technical capability through cohort-based training. Because Doctoral Focal Awards concentrate benefits in their host institutions, cross-institutional design would be essential in a field as broad as microsystems, where a single-cluster award risks leaving adjacent communities outside its scope.

Bringing doctoral training, translational research, and commercial development into closer alignment across institutions—with shared visibility across UKRI's currently distributed and programme-specific mechanisms[249]—would allow skills, infrastructure, and industry engagement to reinforce one another, as demonstrated by coordinated models such as SENSE[250] for sensor and measurement systems, where training, research, and industrial collaboration are linked through a shared focal point. Making programme scope, timelines, and outputs visible across this system would allow capability to be identified, accessed, and built upon more effectively. A broader capability map spanning facilities, firms, and research groups would extend this visibility across the ecosystem, making it easier for companies, researchers, and policymakers to navigate and connect.

In this context, shared capability mapping and a specialised cross-institutional Centre for Doctoral Training represent two primary mechanisms for deepening and systematising the industrial coordination that IMAPS-UK's network already provides, forming a foundation for capabilities to be identified, connected, and translated into sustained industrial activity in the UK.

Read more: The three coordination interfaces this recommendation addresses—industry–academia collaboration, commercialisation frameworks, and ecosystem visibility—are explored in Part III—Coordination: From activity to ecosystem alignment. The Connecting the dots case study in Part III illustrates how proximity and structured connections between complementary capabilities can unlock new value across the ecosystem.

> It's about bringing together a sensors community talking to a processor community, talking to a memory community, talking to a power electronics community—sensors, actuators, and the brain in the middle. The microsystem is the connecting layer, and the whole is greater than the sum of its parts."

Iain Mauchline
Head of semiconductors and innovation lead for electronics, sensors and photonics, Innovate UK

Appendix

A. Defining microsystems

Microsystems resists simple definition, with boundaries often drawn too narrowly or not drawn at all, leaving a field built at the intersection of disciplines without a shared identity to bring it together. This report proposes the following formal definition as a way to reflect the full breadth of the field and give its communities a foundation that they can recognise themselves within, with an expectation that it will continue to evolve through the ecosystem:

Microsystems is a multi-disciplinary field encompassing the **design, fabrication, and integration** of components and systems that exploit scale-dependent phenomena emerging at **micro- and nano-scales**[1] to transduce, process, and control signals, energy, and matter **across multiple physical domains**[2]—including mechanical, electrical, magnetic, optical, fluidic, thermal, chemical, biological, and acoustic—and **device engineered systems** that can act upon the physical world.

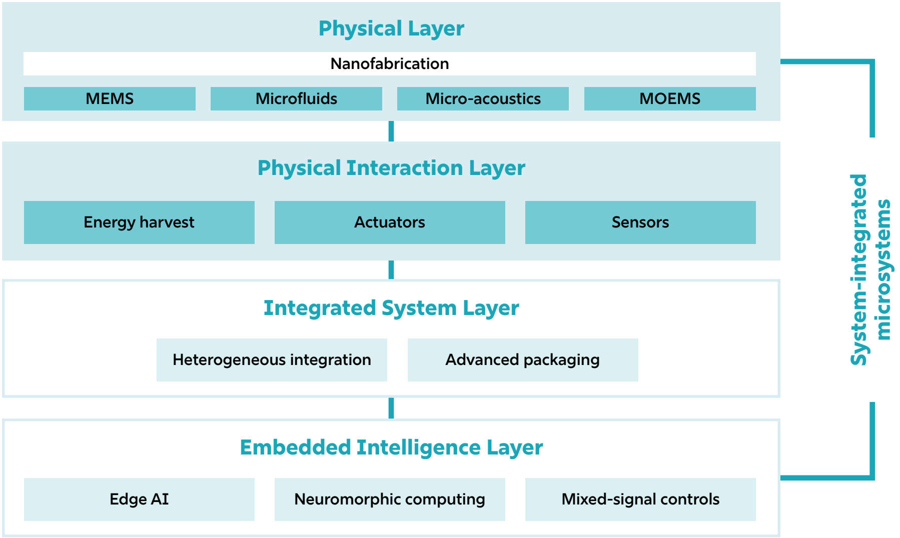
Four key ideas carry the weight of this definition:

1. **Scale-dependent phenomena**: At micro- and nano-scales, physics behaves in ways that become practical to exploit only at the smaller scales—surfaces dominate volumes, fluids behave differently, and quantum effects become detectable, opening up functions difficult if not impossible to achieve at conventional scales.
2. **Multi-domain reach**: Microsystems routinely spans multiple physical domains within a single structure: motion can be converted into electrical signals, fluid flow can interact with biological systems, and light can be guided through micro and nanoscale channels, alongside thermal, chemical, and magnetic effects. Lithographic fabrication techniques—the process of precisely patterning structures at micro- and nano-scales—make this possible at scale, enabling compact systems with a high level of functionality.
3. **System integration**: Because components achieve their intended function only when combined into deployable systems, microsystems extends across the value chain from concept to system-level integration. Advanced packaging and heterogeneous integration are what bring sensing, actuation, optical, fluidic, and electronic functions into a unified architecture, playing a central role in shaping performance, cost, and system-level outcomes.
4. **Transduction**: Microsystems interact with their environment by capturing, processing, and responding to signals. Sensing converts physical, chemical, or biological signals into electrical ones; actuation generates motion and force at small scales, allowing the system to adjust flows, move structures, deliver materials, and further control its surroundings, extending the field's reach from measurement into physical consequence.

Taken to their fullest expression, microsystems cease to be components and become environments: integrated, intelligent, and autonomous physical systems that sense, decide, and act as one. That architecture has a concrete foundation (see Figure 13).

FIGURE 13

The layered architecture of a system-integrated microsystem, from physical devices through to embedded intelligence.



- **At the physical layer**, scale-dependent physical effects are exploited to sense and interact with the immediate environment. Micro-electromechanical systems (MEMS), microfluidics, micro-acoustics, and micro-opto-electromechanical systems (MOEMS) each access different physical domains, yet share a common nanofabrication foundation that allows tools, facilities, and expertise to move fluidly across them, so that boundaries between device families are largely defined by application.
- **At the physical interaction layer**, microsystems draw energy from and interact with their surroundings through energy transduction mechanisms, including sensing signals from the environment and energy harvesting from ambient sources—such as thermal gradients, vibration, and electromagnetic fields—and convert it into controlled physical action through actuation mechanisms such as piezoelectric, electrostatic, thermal, and magnetic, enabling interaction with the physical world beyond passive measurement.
- **At the integrated system layer**, distinct devices are combined into a single deployable system, often across different domains or fabrication approaches. Heterogeneous integration brings components from different technologies into a unified architecture, while advanced packaging governs their assembly, interconnection, and protection—shaping system-level performance, reliability, and cost. Other mechanisms—including interposers, co-packaged optics, chiplets, and system-on-chip architectures extend this capability across specific application contexts.
- **At the embedded intelligence layer**, microsystems process, decide, and act on the signals they capture, closing the loop between sensing and response. This includes on-device computation such as edge AI for machine learning inference, neuromorphic approaches inspired by biological systems, and mixed-signal control that bridges analogue physical signals and digital computation, reflecting a rapidly expanding set of capabilities that enable real-time response to the environment. This layer has no fixed ceiling, with each new addition extending what microsystems can do and where they can operate.

The layers described above share more than they separate: boundaries between device families, integration mechanisms, and embedded intelligence are porous by design, and deliberately so, reflecting taxonomic convention more than technological reality. What unifies them is a common physical foundation in microfabricated structures and mechanisms that exploit scale-dependent phenomena. This suggests a useful, though not universal, way to identify what belongs within microsystems: a device or system falls within the field when its function is realised through microfabricated structures or mechanisms. Framed in this way, the definition remains broad enough for researchers, engineers, and companies across its subdisciplines to recognise themselves, while still providing a clear basis for coordination across research, industry, and policy.

B. Measuring the UK microsystems base

The primary metrics used to quantify economic contribution are gross value added (GVA) and employment. GVA measures the value generated by an industry net of the cost of intermediate inputs, and is the standard indicator used in national accounts to assess an industry's contribution to GDP. Employment is reported as the headcount of jobs sustained, both within the microsystems sector itself and across its wider supply chain.

The assessment covers two channels of economic impact:

- Direct impacts, capturing economic activity generated by microsystems firms themselves, the employment they generate, the revenue they generate, and the economic activities they sustain across the UK economy.
- Indirect (supply chain) impacts, measuring the downstream economic activity supported through microsystems firms' procurement of goods and services from UK-based suppliers, including raw materials, input equipment, transport, and other services.

Induced impacts—those arising from the spending of wages and salaries by employees in direct and indirect activities—are outside the scope of this assessment, due to data availability issues for firm-level remuneration data and Type II multipliers in national accounting statistics.

The modelling methodology draws on an Input-Output (I-O) framework applied to the UK economy, using data published by the Office for National Statistics (ONS). Firm-level data on microsystems companies was compiled from a combination of sources, including The Data City, Companies House and company websites.

Defining microsystems and identifying UK firms

The scope of economic activities classified as 'microsystems' for this study was established through a structured review of the academic and policy literature, including UK microsystems network resources, UKRI/EPSRC research portfolio data, supplemented by expert interviews.

The following economic activities were included within the microsystems definition:

- Manufacturing and fabrication of microsystems devices (e.g. MEMS, microelectronics, microfluidics)
- Design and intellectual property activities specific to microsystems
- Packaging and integration of microsystems components
- Research and development in microsystems technologies

Activities in adjacent sectors, such as broad-scope semiconductor, photonics and quantum manufacturing or generic semiconductor distribution, were excluded from the economic activities of interest. Geographic scope encompasses the whole of the United Kingdom (England, Wales, Scotland and Northern Ireland).

Identifying microsystems companies

A firm-level dataset of UK microsystems companies was constructed using a bottom-up approach, drawing on multiple data sources:

- The Data City, a commercial database that uses machine learning to classify companies by industrial sector and technology activity.
- Companies House, the UK's official register of incorporated companies, is used to verify company status, registered activity, and basic financial data.
- Company websites, LinkedIn and public filings are used to validate firm-level descriptions and screen for microsystems activity.

For each firm identified, the following information was recorded where available: company name and registration number, primary Standard Industrial Classification (SIC) code, a short operational description, UK location, and financial metrics including UK turnover and employee headcount.

The dataset was constructed through an iterative, four-stage validation process:

1. Using open-source research, Companies House, public filings, LinkedIn, and reports and publications from the UK Microsystems Network, a sample of 50 known microsystems companies was identified, alongside a keyword taxonomy of microsystems subcategories and microsystems activities commonly found on company websites.

2. A comprehensive list of 1,250 companies working in the microsystems space was identified using a machine learning (ML) algorithm from The Data City. The algorithm was trained on a sample of 50 known microsystems companies and a keyword taxonomy of microsystems activities commonly found on company websites.
3. The resulting longlist of approximately 1,250 firms was systematically cleaned to remove duplicates, holding companies, non-trading entities, companies with no UK employees, and firms identified as false positives operating in adjacent sectors (semiconductors, photonics, fluidics, quantum, consulting), producing a shortlist of 250 companies.
4. The shortlist was reviewed through a structured expert validation process, resulting in a final validated sample of 102 companies.

Apportionment of activity for diversified firms

A subset of identified companies conducts microsystems manufacturing activities as part of a broader portfolio within a larger diversified industrial group, typically in the defence, automotive and life sciences sectors. For these firms, expert consultation was used to derive apportionment fractions representing the estimated share of each company's revenue and employment attributable to its microsystems activities specifically. These fractions were applied before aggregation to avoid overstating the direct impact estimates.

Calculating direct impacts

Turnover and employees were directly derived from the data provided by The Data City. The number of UK employees for each firm was validated using company filings, LinkedIn, and desk research. Turnover figures were apportioned based on the number of employees microsystems firms employed in the UK.

Our microsystems database revealed that approximately 80% of identified microsystems companies report on one or more of the following 12 SIC codes:

ONS data gathered from the Annual Business Survey (ABS), the Labour Force Survey (LFS) and the ONS input-output tables were used to estimate the gross value added of the microsystems firms in our database. This enabled the calculation of the direct economic impact of microsystems firms in the UK–the sector's gross value-added contribution to UK GDP and the employment it generates.

SIC code	Description	% of firms
26110	Manufacture of electronic components	21%
72190	Other research and experimental development in natural sciences and engineering	12%
26511	Manufacture of electronic (measuring, testing, etc.) equipment, not for industrial process control	11%
72110	Research and experimental development on biotechnology	7%
46520	Wholesale of electronic and telecommunications equipment and parts	5%
26512	Manufacture of electronic industrial process control equipment	4%
28990	Manufacture of other special-purpose machinery n.e.c.	4%
32500	Manufacture of medical and dental instruments and supplies	4%
74909	Other professional, scientific and technical activities (not including environmental consultancy or quantity surveying) n.e.c.	4%
26701	Manufacture of optical precision instruments	3%
71122	Engineering-related scientific and technical consulting activities	3%
71129	Other engineering activities (not including engineering design for industrial processes and production or engineering-related scientific and technical consulting activities)	2%

Calculating indirect impacts

Indirect economic impacts capture the economic activity generated throughout the UK supply chains of microsystems firms, as well as the jobs and output created in other sectors resulting from microsystems firms' procurement of goods and services from domestic suppliers. These are estimated using the ONS Analytical Input-Output Tables within a standard I-O modelling framework.

Input-Output analysis is a well-established methodology for tracing the interdependencies between sectors of an economy. The ONS publishes Analytical Input-Output Tables for the UK economy, derived from the Supply and Use Tables in the national accounts. These tables describe the monetary flows of goods and services between industries and are the basis for computing economic multipliers.

To estimate these effects, a series of output multipliers is derived from the Leontief inverse matrix, constructed from the ONS Analytical Input-Output tables. The ONS I-O framework is structured across 105 product categories at the 2-digit SIC level; accordingly, the firm-level 5-digit SIC code basket characterising the microsystems sector is mapped upward to the corresponding 2-digit categories, enabling the sector to be correctly positioned within the I-O framework. Working within the full 105×105 Leontief inverse matrix allows indirect impacts to be observed across all product categories simultaneously, providing a granular picture of where supply chain value is generated across the wider economy.

Before the multiplier is applied, turnover is adjusted to account for import leakage - the share of output supported by imported rather than domestically produced inputs—ensuring that only economic activity within the UK economy is captured. Multipliers are then constructed as a weighted average across the relevant SIC codes, with weights reflecting each code's share of total employment. This produces a figure for total UK output supported by the sector, encompassing both the direct output of microsystems firms and the successive rounds of domestic supplier activity they generate. Total output is subsequently converted to GVA using sector-level output-to-GVA ratios applied at the 2-digit SIC level, reflecting the significant variation in value-added intensity across the industries represented in the microsystems supply chain. Indirect GVA is then calculated as the difference between this total GVA figure and the direct GVA estimate derived separately.

Indirect employment impacts are estimated using the ONS Employment Multipliers and Effects matrix, which provides employment coefficients, measured as total jobs supported per £1 million of output, split by I-O sector, applied to total indirect output across the 105 product categories to produce an estimate of the number of jobs supported indirectly across the wider UK economy.

Limitations

Economic impact assessments involve modelling choices and data constraints that shape the precision and interpretation of results. The following limitations apply to this assessment and should be kept in mind when interpreting the findings of the economic impact model.

Apportionment of diversified firms

For diversified firms, the share of revenue and employment attributable to microsystems activities was derived through expert consultation rather than from observed financial data. The resulting apportionment fractions are therefore estimates, and plausible variation in these fractions could materially affect the direct GVA and employment totals reported for the sector.

Apportionment of turnover

For firms operating across multiple geographies, total reported turnover was apportioned to UK activities using the share of total employees based in the UK. This approach assumes that revenue is generated in direct proportion to headcount, which may not hold in practice. Microsystems manufacturing and R&D activities can vary considerably in their revenue intensity relative to employment: a UK-based design or intellectual property function may account for a disproportionately large share of revenue relative to its headcount, while a UK assembly or testing operation may be employment-intensive but generate comparatively modest turnover.

SIC code mapping

The mapping of 5-digit SIC codes to the 2-digit product categories used in the ONS Input-Output framework necessarily entails a loss of industrial granularity. The technical coefficients within the A matrix, which govern how indirect impacts are distributed across supply chain industries, are calibrated to the average input structure of all firms within a given 2-digit category. Where microsystems firms occupy a narrowly defined 5-digit niche within a broader 2-digit category, their actual purchasing patterns may differ materially from this average, introducing imprecision in the distribution of indirect impacts across product categories.

Microsystems activities within large industrial conglomerates

Significant microsystems activity occurs within large, diversified companies operating in sectors such as defence, aerospace and automotive. These firms typically report under broader product categories that do not allow distinction of microsystems-specific activities. While the size of microsystems activities within these companies has been estimated using informed assumptions validated by external experts, the true extent of microsystems contributions may be only partially captured, or omitted, from the analysis.

Induced impacts

The assessment does not quantify induced impacts - the additional economic activity arising from the spending of wages and salaries earned by workers in direct and indirect activities. This is a common scope limitation in economic impact assessments, reflecting the limited availability of firms' spending on salaries and the absence of pre-computed Type II multipliers at the required level of disaggregation in national accounting publications.

Static framework

Input-Output analysis assumes fixed production coefficients and does not capture behavioural responses, for example, how firms may adjust their input mix in response to changes in demand. The results should therefore be interpreted as a snapshot estimate of economic contribution at a given point in time, rather than a dynamic forecast.

Main data sources

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Notes

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